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(71)Applicant : RICOH CO LTD

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(72)Inventor : IWATA NAOTAKA

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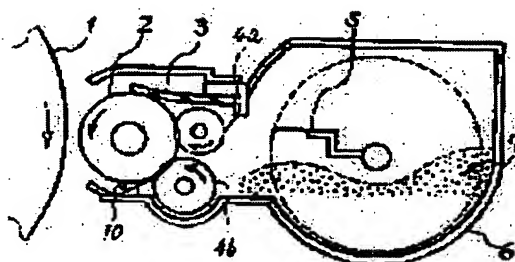
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(54) DEVELOPING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a device capable of uniformly electrifying a developer layer on the developer carrier, making the layer thickness definite, dispensing with a sealing member for sealing a gap in between a developing unit wall and the developer carrier, and making its constitution simplified even if it is disposed therein.

SOLUTION: This device is provided with toner feeding rotary rollers 4a and 4b in a rotary type for feeding the toner to a developing roller 2, on the upper part and the lower part corresponding to a position where the developing roller 2 is located, while held in contact with the roller 2 on a position of the toner hopper 6 side from the developing roller 2. In the same time of the above, the respective rotary direction of the feeding rollers 4a and 4b, is set so as to become



mutually opposite direction, so as to shift the toner lying in between the feeding rollers 4a and 4b, from the toner hopper 6 side to the developing roller 2 side.

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CLAIMS

[Claim(s)]

[Claim 1] Developer support which rotates so that a peripheral surface of a side which an one component system developer which **(ed) an adjuvant outside if needed [that it is characterized by providing the following] is electrified in desired polarity, supports, and is held in a development counter may move to the upper part from a lower part, A developer which develops a latent image on latent-image support using a developer on this developer support that has developer specification-part material which regulates a developer on this developer support to predetermined thickness, and was regulated by this developer specification-part material The first developer feed zone material which rotates so that this developer support may be contacted by developer reservoir side rather than this developer support and a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side The second developer feed zone material which is the developer conveyance direction downstream and rotates rather than this first developer feed zone material in the direction which is arranged by this developer support, contact, or non-contact rather than this developer specification-part material at the upstream, and is different from this first developer feed zone material

[Claim 2] A developer of claim 1 characterized by arranging both members so that it may have a gap between [whose] the above-mentioned first developer feed zone material and the above-mentioned second developer feed zone material is the degree in which a developer can pile up.

[Claim 3] A developer characterized by providing the following Developer support which rotates so that a peripheral surface of a side which an one component system developer which **(ed) an adjuvant outside if needed is electrified in desired polarity, supports, and is held in a development counter may move to the upper part from a lower part In a developer which develops a latent image on latent-image support using a developer on this developer support that has developer specification-part material which regulates a developer on this developer support to predetermined thickness, and was regulated by this developer specification-part material While preparing developer feed zone material of a rotation mold which rotates in a hand of cut and this direction of this developer support, contacting this developer support, and supplies a developer to this developer support by the upstream of the developer conveyance direction from this developer support A developer conveyance member rotated to hard flow above this developer feed zone material with a hand of cut of this developer support and this developer feed zone material

[Claim 4] A developer characterized by providing the following Developer support which rotates so that a peripheral surface of a side which an one component system developer which **(ed) an adjuvant outside if needed is electrified in desired polarity, supports, and is held in a development counter may move to the upper part from a lower part In a developer which develops a latent image on latent-image support using a developer on this developer support that has developer specification-part material which regulates a developer on this developer support to predetermined thickness, and was regulated by this developer specification-part material While preparing developer feed zone material of a rotation mold which rotates to hard flow with a hand of cut of this developer support, contacting this developer support, and supplies a developer to this developer support by the upstream of the developer conveyance

direction from this developer support A developer conveyance member of this developer feed zone material caudad rotated in a hand of cut and this direction of this developer support

[Claim 5] Developer support which rotates so that a peripheral surface of a side which an one component system developer which *(ed) an adjuvant outside if needed [that it is characterized by providing the following] is electrified in desired polarity, supports, and is held in a development counter may move to the upper part from a lower part, A developer which develops a latent image on latent-image support using a developer on this developer support that has developer specification-part material which regulates a developer on this developer support to predetermined thickness, and was regulated by this developer specification-part material The first developer feed zone material which rotates so that this developer support may be contacted by developer reservoir side rather than this developer support and a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side It is the developer conveyance direction downstream from this first developer feed zone material. Rather than this developer specification-part material to the upstream Are arranged so that this developer support may be contacted, and the second developer feed zone material which rotates in the different direction from this first developer feed zone material is prepared. Said first developer feed zone material and the second developer feed zone material are constituted using a foaming resin member, and it is larger foaming density than foaming density of said second developer feed zone material about said first developer feed zone material.

[Claim 6] Developer support which rotates so that a peripheral surface of a side which an one component system developer which *(ed) an adjuvant outside if needed is electrified in desired polarity, supports, and is held in a development counter may move to the upper part from a lower part, In a developer which develops a latent image on latent-image support using a developer on this developer support that has developer specification-part material which regulates a developer on this developer support to predetermined thickness, and was regulated by this developer specification-part material The first developer feed zone material which rotates so that this developer support may be contacted by developer reservoir side rather than this developer support and a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side, It is the developer conveyance direction downstream from this first developer feed zone material. Rather than this developer specification-part material to the upstream Are arranged so that this developer support may be contacted, and the second developer feed zone material which rotates in the different direction from this first developer feed zone material is prepared. A developer characterized by arranging each feed zone material so that the amount of interlocking of said second developer feed zone material to said developer support may be made larger than the amount of interlocking of said first developer feed zone material.

[Claim 7] Developer support which rotates so that a peripheral surface of a side which an one component system developer which *(ed) an adjuvant outside if needed is electrified in desired polarity, supports, and is held in a development counter may move to the upper part from a lower part, In a developer which develops a latent image on latent-image support using a developer on this developer support that has developer specification-part material which regulates a developer on this developer support to predetermined thickness, and was regulated by this developer specification-part material The first developer feed zone material which rotates so that this developer support may be contacted by developer reservoir side rather than this developer support and a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side, It is the developer conveyance direction downstream from this first developer feed zone material. Rather than this developer specification-part material to the upstream Are arranged so that this developer support may be contacted, and the second developer feed zone material which rotates in the different direction from this first developer feed zone material is prepared. A developer characterized by having constituted said first developer feed zone material and the second developer feed zone material using a foaming resin member, and a resin thick twist of said first developer feed zone material thickening resin thickness of said second developer feed zone material.

[Claim 8] Developer support which rotates so that a peripheral surface of a side which an one

component system developer which ******(ed) an adjuvant outside if needed is electrified in desired polarity, supports, and is held in a development counter may move to the upper part from a lower part, In a developer which develops a latent image on latent-image support using a developer on this developer support that has developer specification-part material which regulates a developer on this developer support to predetermined thickness, and was regulated by this developer specification-part material The first developer feed zone material which rotates so that this developer support may be contacted by developer reservoir side rather than this developer support and a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side, It is the developer conveyance direction downstream from this first developer feed zone material. Rather than this developer specification-part material to the upstream A developer characterized by having been arranged so that this developer support may be contacted, having prepared the second developer feed zone material which rotates in the different direction from this first developer feed zone material, and making a support shaft of said first developer feed zone material thicker than a support shaft of said second developer feed zone mater

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the developer of image formation equipments, such as a copying machine, facsimile, and a printer, and relates to the developer which desired polarity is electrified and uses for the development of a latent-image support top latent image in detail the one component system developer which ** (ed) the adjuvant outside if needed.

[0002]

[Description of the Prior Art] In the image formation equipment which forms a latent image on image support and visualizes this with a developer, the developer using points, such as a miniaturization of a developer, low-cost-izing, and high-reliability, to an one component system developer is advantageous. When colorizing especially, it is more advantageous than a magnetic one component system developer at the point that it is highly transparent to use a nonmagnetic one component system developer. What has the developer support conveyed in accordance with the predetermined circulation path which supports an one component system developer on the surface, and includes a development field as a developer using an one component system developer, the reservoir which stores an one component system developer, and a developer supply means to supply the one component system developer which contacts this developer support and is stored by this developer reservoir to this development developer support is known (for example, refer to JP,60-229057,A and JP,61-42672,A).

[0003] and also various-kinds-make the proposal for making [many] the amount of developers per [which is supported on the above-mentioned developer support] unit area in this kind of developer -- ****. For example, these people use developer support previously from the dielectric section distributed in minute area regularly [the surface] or in irregular as developer support, and the grounded current carrying part. In the contact section with the developer feed zone material which rotates in the location which contacts on this developer support and its surface Frictional electrification of the one component system developer is carried out, and frictional electrification of said dielectric section is carried out with developer feed zone material and an one component system developer, and much minute electric fields are formed near [said] the developer support surface. By this minute electric field The developer which make transfer an one component system developer to developer support from developer feed zone material, and a multilayer is made to support on developer support was proposed (JP,4-127177,A). The plan and drawing 9 (b) which show a part of surface of the developing roller as developer support in the example of the developer which drawing 9 (a) requires for this proposal are an X-X cross section in this drawing (a). As for this developing roller, the grounded current carrying part 51 and the dielectric section 52 which consists of dielectric materials have the surface over which it was regularly distributed in minute area, and the minute electric field expressed with the line of electric force shown in this drawing (b) are formed. The proposal of such a developer is made in view of the following backgrounds.

[0004] For example, as for the toner coating weight on developer support, in the development method using a nonmagnetic one component system developer (henceforth a toner), it is desirable on image

support for about two 0.5 - 0.7 mg/cm toner coating weight to be what is obtained, respectively on about two 0.6 - 1.0 mg/cm toner coating weight and a transfer paper. The toner coating weight on this image support and a transfer paper is influenced by not only the toner coating weight on developer support but the relative velocity of the image support and developer support in a development field. However, according to this kind put in practical use conventionally of developer, since one layer and coating weight had few toner layers on developer support, the toner coating weight on developer support was - 0.5 mg/cm², and in order to obtain the toner coating weight of the request by the above image support up etc., the speed of developer support needed to be set up by 2 to 4 times the speed of image support. Thus, since the lack of toner coating weight on developer support is covered, in setting up rotation of developer support highly, when improvement in the speed of image formation speed is not only difficult, but develops the solid section, it also generates the phenomenon of the "toner back end approach" to which the concentration of the back end section of an image becomes high. Although this phenomenon was not a big problem by monochrome image, in the color picture, in order to penetrate a toner and to carry out vision of the color, concentration became deep in the back end section, and, especially in the case of the heavy image, the fault of becoming different colors had arisen.

[0005] In order to obtain desired toner coating weight by the image support up etc., without generating the phenomenon of such "toner back end approach", while bringing the speed of developer support close to the speed of image support, that is, bringing it close to uniform development, it is required to make [many] toner coating weight to a developer support top as compared with the former. In order to secure mostly sufficient toner coating weight on image support or a transfer paper in uniform development, specifically, it is necessary to make toner coating weight on developer support into 1.0 mg/cm² at least by the contact developing-negatives method with sufficient development effectiveness by the non-contact developing-negatives method at least 0.8 mg/cm² and development effectiveness are bad. In order to obtain the toner coating weight on such developer support, it needed to carry out to more than two-layer, i.e., multilayer toner thickness. And since it also became causes, such as aggravation of development transition, natural-complexion dirt, and resolution deterioration, when the non-charged toner and the reverse electrification toner were contained in the toner layer on the developer support conveyed to a development field, to form the toner layer which tends to become the lack of electrification and which all the toners of a toner layer also including the toner of the management of the toner layer on developer support were charged, and was stabilized by the amount distribution of toner electrifications was desired. Moreover, the amount of average electrifications of a toner was wanted to become within the limits of 5-10microc/g.

[0006] Then, the above-mentioned developer is proposed as a developer which can form the multilayer toner layer by which the amount of electrifications was stabilized on developer support. Since according to the developer concerning this proposal an one component system developer is transferred to developer support from developer feed zone material and the multilayer was made to support on developer support by the minute electric field formed on developer support, the multilayer toner layer by which the amount of electrifications was stabilized could be formed on developer support, and stabilization of a system and improvement in image quality were attained.

[0007]

[Problem(s) to be Solved by the Invention] By however, the minute electric field formed on developer support which was mentioned above In the 1 component developer which make transfer an one component system developer to this developer support from developer feed zone material, and a multilayer is made to support on this developer support When the above-mentioned developer feed zone material 4 and the above-mentioned developer support 2 are rotating in this direction, When rotating to the counterclockwise rotation as shown in drawing 10 , for example, a part of one component system developer supplied to this developer support 2 side from the above-mentioned developer reservoir 6 Without passing through the field where this developer feed zone material 4 and this developer support contact, it is suddenly conveyed on this developer support 2, and there is a possibility that a developer layer may be formed of the developer specification-part material 3. Thus, after the developer was conveyed, it was in the condition with inadequate frictional electrification, and since a developer layer

was moreover more thickly formed on this developer support 2, there was fault that there was a possibility that development nonuniformity and developer scattering may arise.

[0008] Moreover, when a developer was consumed so much by solid development, amount of supply sufficient in one developer supply actuation was not obtained, and if developer support did not pass through a developer supply field several times, desired thickness and the desired amount of electrifications were not able to be obtained.

[0009] moreover, as shown in drawing 11, when this developer feed zone material 4 rotates clockwise and it is rotating in the direction in which this developer feed zone material 4 differs from the developer support 2 mutually Since the one component system developer supplied to this developer support 2 side from this developer reservoir 6 is conveyed to the field to which the lower part of this developer feed zone material 4 is passed, and this developer feed zone material 4 and this developer support 2 contact, electrification of the developer supported by this developer support 2 is carried out to homogeneity. However, since the seal device 10 of a ***** sake is not only needed, but the burden placed on this seal device 10 became large so that the developer conveyed in this developer support 2 lower part may not disperse from between this developer support 2 and development counter walls in this case, there was a trouble that the fault that the device of a ***** sake will become complicated certainly produced this developer. In addition, the above-mentioned fault may be produced from developer feed zone material by the minute electric field which were mentioned above and which are formed on developer support not only in the developer which transfers an one component system developer to developer support.

[0010] Though the seal member which this invention is made in view of the above-mentioned trouble, and the place made into the first purpose can attain electrification equalization of the developer layer on developer support and fixed-ization of thickness in the developer which uses an one component system developer, and carries out the seal of the gap of a development counter wall and developer support is made unnecessary and prepared, it is offering the developer which can simplify the configuration. Moreover, the place made into the second purpose is offering the developer which can prevent generating with insufficient developer supply certainly by supplying a developer to up to developer support certainly in one supply actuation, even if a developer is consumed so much by solid development.

(The following, margin)

[0011] [0.2mm or more and 2.0mm or less]

[Means for Solving the Problem] Developer support which rotates so that a peripheral surface of a side which claim 1 thru/or a developer of 10 electrify an one component system developer which *(ed) an adjuvant outside if needed in desired polarity, supports it, and is held in a development counter may move to the upper part from a lower part, It is the developer which develops a latent image on latent-image support using a developer on this developer support that has developer specification-part material which regulates a developer on this developer support to predetermined thickness, and was regulated by this developer specification-part material.

[0012] In order to attain the first purpose of the above, in this basic configuration a developer of claim 1 The first developer feed zone material which rotates so that this developer support may be contacted by developer reservoir side rather than this developer support and a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side, It is characterized by being the developer conveyance direction downstream and preparing the second developer feed zone material which rotates in the direction which is arranged by this developer support, contact, or non-contact rather than this developer specification-part material at the upstream, and is different from this first developer feed zone material rather than this first developer feed zone material.

[0013] Furthermore, it is characterized by a developer of claim 2 arranging both members so that it may have a gap between [whose] the above-mentioned first developer feed zone material and the above-mentioned second developer feed zone material is the degree in which a developer can pile up in a developer of claim 1.

[0014] Moreover, a developer of claim 3 is the upstream of the developer conveyance direction from

this developer support in the above-mentioned basic configuration. While preparing developer feed zone material of a rotation mold which rotates in a hand of cut and this direction of this developer support, and supplies a developer to this developer support, contacting this developer support It is characterized by a hand of cut of this developer support and this developer feed zone material preparing a developer conveyance member rotated to hard flow above this developer feed zone material.

[0015] Moreover, it is characterized by preparing a developer conveyance member of this developer feed zone material caudad rotated in a hand of cut and this direction of this developer support, while a developer of claim 4 is the upstream of the developer conveyance direction, and contacted this developer support from this developer support in the above-mentioned basic configuration, and preparing developer feed zone material of a rotation mold which rotates a hand of cut of this developer support to hard flow, and supplies a developer to this developer support.

[0016] In order to attain the second purpose of the above, a developer of claim 5 The first developer feed zone material which rotates so that this developer support may be contacted by developer reservoir side rather than this developer support and a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side in the above-mentioned basic configuration, It is the developer conveyance direction downstream from this first developer feed zone material. Rather than this developer specification-part material to the upstream Are arranged so that this developer support may be contacted, and the second developer feed zone material which rotates in the different direction from this first developer feed zone material is prepared. It is characterized by having constituted said first developer feed zone material and the second developer feed zone material using a foaming resin member, and constituting said first developer feed zone material so that it may have larger foaming density than foaming density of said second developer feed zone material.

[0017] Moreover, a developer of claim 6 contacts this developer support by developer reservoir side rather than this developer support in the above-mentioned basic configuration. The first developer feed zone material which rotates so that a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side, It is the developer conveyance direction downstream from this first developer feed zone material. Rather than this developer specification-part material to the upstream Are arranged so that this developer support may be contacted, and the second developer feed zone material which rotates in the different direction from this first developer feed zone material is prepared. It is characterized by arranging each feed zone material so that the amount of interlocking of said second developer feed zone material to said developer support may be made larger than the amount of interlocking of said first developer feed zone material.

[0018] Moreover, a developer of claim 7 contacts this developer support by developer reservoir side rather than this developer support in the above-mentioned basic configuration. The first developer feed zone material which rotates so that a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side, It is the developer conveyance direction downstream from this first developer feed zone material. Rather than this developer specification-part material to the upstream Are arranged so that this developer support may be contacted, and the second developer feed zone material which rotates in the different direction from this first developer feed zone material is prepared. Said first developer feed zone material and the second developer feed zone material are constituted using a foaming resin member, and it is characterized by a resin thick twist of said first developer feed zone material thickening resin thickness of said second developer feed zone material.

[0019] Moreover, a developer of claim 8 contacts this developer support by developer reservoir side rather than this developer support in the above-mentioned basic configuration. The first developer feed zone material which rotates so that a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side, It is the developer conveyance direction downstream from this first developer feed zone material. Rather than this developer specification-part material to the upstream It is arranged so that this developer support may be contacted, and the second developer feed zone material which rotates in the different direction from this first developer feed zone material is prepared, and it is characterized by making a support shaft of said first

developer feed zone material thicker than a support shaft of said second developer feed zone material. [0020] Moreover, a developer of claim 9 contacts this developer support by developer reservoir side rather than this developer support in the above-mentioned basic configuration. The first developer feed zone material which rotates so that a development counter wall of the development counter lower part and a field which counters may move to a developer stores dept. side, It is the developer conveyance direction downstream from this first developer feed zone material. Rather than this developer specification-part material to the upstream Are arranged so that this developer support may be contacted, and the second developer feed zone material which rotates in the different direction from this first developer feed zone material is prepared. For a velocity ratio of said first developer feed zone material to said developer support, ***** on said developer support Scraping, It is characterized by being the degree which can be conveyed in a development counter, and having set or less to one, being the degree which can supply sufficient quantity of a developer which can be charged on said developer support, and setting a velocity ratio of said second developer feed zone material to said developer support or less to one.

[0021] Furthermore, in claims 1, 3, 4, 5, 6, 7, and 8 or a developer of 9, a developer of claim 10 takes up a crevice between the above-mentioned developer support and a development counter wall of the development counter lower part, and is characterized by preparing a seal member which prevents developer scattering from this crevice.

[0022] In order to attain the first purpose of the above, claim 11 thru/or a developer of 14 Developer support conveyed to a development field which an one component system developer which ** (ed) an adjuvant outside, if needed is electrified in desired polarity, supports, and counters latent-image support, It has developer specification-part material which regulates a developer which is supported on this developer support and conveyed to this development field to predetermined thickness. In a developer which develops a latent image on latent-image support using a developer on this developer support regulated by this developer specification-part material It contacts or approaches from a developer reservoir side to this developer support, respectively, and has a basic configuration which prepared the first and second developer feed zone material which rotates so that a developer by the side of this developer stores dept. may be moved to this developer support side through a respectively mutual opposite field.

[0023] Especially, a developer of claim 11 is characterized by preparing the above-mentioned first and second developer feed zone material so that a closest-approach gap in this mutual opposite field may become more than the following minimum and a thing within the limits below a maximum in the above-mentioned basic configuration. Namely, also when developer consumption by development inclines toward one side by longitudinal direction of the above-mentioned developer support, a minimum of the above-mentioned range Deviation of the above-mentioned amount of developers in a field can be suppressed to a degree from which the amount of supply developers to the above-mentioned developer support does not become an ununiformity by the above-mentioned developer support longitudinal direction. It is the minimum gap which can secure developer inflow from the above-mentioned developer reservoir side to a field inserted into both developer feed zone material and developer support. A maximum of the above-mentioned range moreover, a developer pressure in a field inserted into both the above-mentioned developer feed zone material and developer support Developer feed zone material of the developer conveyance direction downstream adhere to the developer support surface and according to the above-mentioned developer support among the above 1st and the 2nd developer feed zone material, It is the greatest gap which can acquire restraining force over return of a developer from this field through the above-mentioned closest-approach gap section to the above-mentioned stores dept. side securable for a degree to which the amount of developers which passes contact to this developer support or the contiguity section does not become unstable.

[0024] Moreover, a developer of claim 12 is characterized by establishing a voltage impression means to form the potential difference which forms electric field of sense to which a developer charged in desired polarity towards a developer feed zone material side of another side between the above 1st and the 2nd developer feed zone material from a developer feed zone material side of the developer conveyance

direction upstream by the above-mentioned developer support is moved in the above-mentioned basic configuration.

[0025] Moreover, in the above-mentioned basic configuration, a developer of claim 13 is characterized by setting up the length of both developer specification-part material so that contact width of face or contiguity width of face may become large rather than developer feed zone material of another side. [as opposed to this developer support in a direction of developer feed zone material of the developer conveyance direction upstream by the above-mentioned developer support]

[0026] A developer of claim 14 is set in the above-mentioned basic configuration. Moreover, as above-mentioned first and second developer feed zone material It sets on this developer support cross direction outside rather than the this first and second developer feed zone material using a thing of width of face narrower than width of face of the above-mentioned developer support. Specification-part material which regulates migration of a developer on this developer support to this developer support cross direction outside the first and second developer feed zone material in the developer conveyance direction by the above-mentioned developer support -- it is characterized by preparing over a portion when each contacts or approaches to this developer support.

[0027] In a developer of claim 1, a developer is conveyed by a developer conveyance means held in a developer stores dept. between the first developer feed zone material and the second developer feed zone material. A conveyed developer moves to a developer support side between the first developer feed zone material and the second developer feed zone material. And the second developer feed zone material regulates a developer to some extent, before lamination of the developer supported with a surface of action of the first developer feed zone material and developer support on developer support is carried out by developer specification-part material. Moreover, this second developer feed zone material passes the opposite section of this second developer feed zone material and developer support, it moves a developer which moved above this second developer feed zone material, without being supported on developer support so that it may return to a developer stores dept. side, and lamination is made not to be carried out by developer specification-part material. On the other hand, this first developer feed zone material is the surface of action of developer support and this first developer feed zone material, and fails to scratch a developer which remained on developer support after development termination while it supplies a developer which is not charged [which was conveyed between these second developer feed zone material] on developer support. Furthermore, a developer which this first developer feed zone material failed to scratch caudad is moved so that it may return to a developer stores dept. side.

[0028] In a developer of claim 2, developer **** is formed by developer conveyed from a developer reservoir side between the above-mentioned second developer feed zone material and the first developer feed zone material. Furthermore, it moves above the second developer feed zone material, without being supported on developer support, and a developer returned to a developer stores dept. side by this second developer feed zone material and a developer which failed to be scratched by this first developer feed zone material from developer support after development, and was returned to a developer stores dept. side are also supplied to developer ****.

[0029] In a developer of claim 3, developer feed zone material in contact with developer support rotates in a hand of cut and this direction of developer support which are rotated so that a peripheral surface of a side held in a development counter may move to the upper part from a lower part, and supplies a developer to developer support. On the other hand, with a hand of cut of developer support and developer feed zone material, by rotating to hard flow, a developer conveyance member prepared above developer feed zone material conveys between developer feed zone material and developer conveyance members, and moves a developer conveyed at this feed zone material side to a developer support side with a developer conveyance means which it has in a developer reservoir. Moreover, it passes through between a developer conveyance member and developer support, and without making it pile up in the upper part of a developer conveyance member, a developer which moved above a developer conveyance member, without being supported on developer support is conveyed so that it may return to a developer reservoir side smoothly. It prevents that a developer which was not supported on developer support is superfluously stuffed by this between developer specification-part material which is in contact with the

developer support surface and this surface. And since a developer which intervenes between a developer conveyance member and developer feed zone material is certainly conveyed on developer support by rotation of these each part material, amounts of a developer supplied on developer support do not run short.

[0030] In a developer of claim 4, developer feed zone material in contact with developer support rotates to a hand of cut and hard flow of developer support which are rotated so that a peripheral surface of a side held in a development counter may move to the upper part from a lower part, and supplies a developer to developer support. On the other hand, developer feed zone material is prepared caudad, and a developer conveyance member rotated in a hand of cut and this direction of developer support conveys between developer feed zone material, and moves a developer to a developer stores dept. side at a developer support side. Moreover, a developer conveyed under the developer conveyance member through between developer support and developer conveyance members is conveyed so that it may return to a developer reservoir side. Thereby, a developer with which a developer conveyance member failed to be scratched caudad prevents that a developer conveyance member piles up as it is caudad. And since a developer which intervenes between a developer conveyance member and developer feed zone material is certainly conveyed on developer support by rotation of these each part material, amounts of a developer supplied on developer support do not run short.

[0031] In a developer of claim 5, a developer scraping function is raised about the first developer feed zone material by making foaming density of the second developer feed zone material larger than the first developer feed zone material. Moreover, it is made to pass a developer made to pile up in a field surrounded by the first developer feed zone material, the second developer feed zone material, and developer support through the contact section of the second developer feed zone material and developer support about the second developer feed zone material, and circulation of a developer in a developer is promoted, and frictional electrification effectiveness is raised.

[0032] In a developer of claim 6, driving torque is reduced about the first developer feed zone material by making the amount of interlocking of the second developer feed zone material to developer support larger than the amount of interlocking of the first developer feed zone material. Moreover, while carrying out frictional electrification of the developer which passes the contact section with developer support about the second developer feed zone material efficiently, the amount of supply on developer support before developer specification-part material passage is optimized.

[0033] In a developer of claim 7, when thickness of the second developer feed zone material also thickens a thick twist of the first developer feed zone material, elastic force of a thick portion is weakened about the first developer feed zone material, and developer scraping effectiveness on developer support after development is raised further. Moreover, it is made to stick elastically on the above-mentioned developer support about the second developer feed zone material, and developer electrification / supply effectiveness is raised further.

[0034] In a developer of claim 8, deflection and a deflection of a support shaft of the first developer feed zone material which scratch a developer which remained on developer support after development are mitigated by making a support shaft of the first developer feed zone material thicker than a support shaft of the second developer feed zone material.

[0035] In a developer of claim 9, since a velocity ratio of the first developer feed zone material to developer support is the degree which can convey development ***** on developer support in scraping and a development counter at least, conveyance effectiveness which conveys scraping effectiveness and a scratched developer of development ***** on developer support in a development counter is maintainable. Moreover, unlike a case where it is set as a larger velocity ratio than 1, it can prevent that a developer is superfluously supplied on developer support after passing the contact section of developer support and the first developer feed zone material by making 1 into a maximum. Moreover, since a velocity ratio of the second developer feed zone material to developer support is the degree which can supply sufficient quantity of a developer which can be charged on developer support at least, developer supply effectiveness and electrification effectiveness to a developer support top are maintainable. Moreover, unlike a case where it is set as a larger velocity ratio than 1, it

can prevent that a developer is superfluously supplied on developer support after passing the contact section of developer support and the first developer feed zone material by making 1 into a maximum. [0036] In a developer of claim 10, developer scattering from this crevice is prevented by closing with a seal member which carries out the seal of the crevice between the above-mentioned developer support and a development counter wall of the development counter lower part. Moreover, a developer with which the above-mentioned first developer feed zone material failed to be scratched caudad is moved so that the first developer feed zone material may return to a developer stores dept. side, and it is made for an overpressure by developer not to be applied to said seal member.

[0037] In claim 11 thru/or a developer of 14, it moves to a developer support side through an opposite field between both developer feed zone material by first and second rotations of developer feed zone material, and a developer by the side of a developer stores dept. is supplied to the surface of developer support. Thus, developer feed zone material of the developer conveyance direction downstream adhere to developer support among supplied developers, and according to the above-mentioned developer support among the above 1st and the 2nd developer feed zone material, A developer which passed contact to this developer support or the contiguity section is regulated by predetermined thickness by developer specification-part material, and is conveyed to a development field which counters with latent-image support by developer support further, and development of this latent-image support top latent image is presented with it.

[0038] Here, a developer was supplied to a field surrounded by both the above-mentioned developer feed zone material and developer support by this both developer feed zone material from a developer reservoir side, and predetermined ***** has arisen. This ***** can perform frictional electrification of a developer between both developer feed zone material or developer support good.

[0039] moreover, right child developer feed zone material since it rotates so that the above-mentioned first and second developer feed zone material may move a developer by the side of this developer stores dept. to a developer support side through a respectively mutual opposite field -- a surface portion into which contact ***** with each developer support passed the contiguity section separates from developer support, and moves to a developer stores dept. side. By this migration, this contact ***** can move a developer which has not adhered to the developer support surface which exists near the surface portion immediately after passing the contiguity section to a developer stores dept. side. Therefore, a developer which conveyance to a development field is regulated and stops at the above-mentioned developer specification-part material among the above 1st and the 2nd developer feed zone material near the developer feed zone material of the developer conveyance direction downstream by the above-mentioned developer support is returned to a developer stores dept. side by developer feed zone material of this developer conveyance direction downstream. Moreover, from a development support surface portion which passed through a development field and has returned in a development counter, a developer which failed to be scratched by developer feed zone material of another side, for example is returned to a developer stores dept. side by developer feed zone material of this another side.

[0040] And a setup of a closest-approach gap [in / on a developer of claim 11 and / an opposite field of the above-mentioned first developer feed zone material and the second developer feed zone material] Since it is what can fully secure developer inflow from the above-mentioned developer reservoir side to a field inserted into both developer feed zone material and developer support, Also when developer consumption by development inclines toward one side by longitudinal direction of the above-mentioned developer support, deviation of the amount of developers in the above-mentioned field can be suppressed to a degree from which the amount of supply developers to the above-mentioned developer support does not become an ununiformity by the above-mentioned developer support longitudinal direction.

[0041] Furthermore, since a setup of the above-mentioned closest-approach gap is also what can acquire sufficient restraining force over return of a developer from the above-mentioned field through this closest-approach gap section to a developer stores dept. side, it can secure sufficient developer pressure in the above-mentioned field. Therefore, it can adhere to the developer support surface and the amount of developers which passes contact to developer feed zone material of the developer conveyance

direction downstream by the above-mentioned developer support and this developer support or the contiguity section among the above 1st and the 2nd developer feed zone material can be stabilized. [0042] Moreover, in a developer of claim 12, the potential difference is formed between the above 1st and the 2nd developer feed zone material with a voltage impression means, and electric field of sense to which a developer charged in desired polarity towards a developer feed zone material side of another side from a developer feed zone material side of the developer conveyance direction upstream by the above-mentioned developer support is moved are formed. Only a developer charged in desired polarity in a field inserted into the first and second developer feed zone material by this electric field is sent into a developer support side of another side, and a developer charged in being un-charged or reversed polarity is sent to a developer feed zone material side of the above-mentioned developer conveyance direction upstream. A developer sent into a developer support pair side of above-mentioned another side has high probability sent to contact to developer support, or the contiguity section by this developer support as it is, and after frictional electrification of most developers sent in this way is carried out in connection with passing this contact or the contiguity section, it is conveyed by developer support at a developer specification-part material side. On the other hand, if a developer sent to a developer feed zone material side of the above-mentioned developer conveyance direction upstream does not pass contact or the contiguity section of developer support of above-mentioned another side to developer support further after it is sent to contact to developer support, or the contiguity section by this developer feed zone material and frictional electrification is carried out here, it is not conveyed at a developer specification-part material side. While conveying intensively promptly a developer charged in desired polarity by this in a field inserted into the first and second developer feed zone material to a developer specification-part material side After a developer charged in being un-charged or reversed polarity in this field is charged in desired polarity by making an opportunity contacting developer feed zone material and developer support, and carrying out frictional electrification increase, it is conveyed to a developer specification-part material side.

[0043] Moreover, in a developer of claim 13, contact width of face or contiguity width of face is larger than developer feed zone material of another side. [as opposed to this developer support in a direction of developer feed zone material of the developer conveyance direction upstream by the above-mentioned developer support] Here, a pressure of a developer is high and, as for a field across which it faced between the first and second developer feed zone material, a developer tends to blow off outside in a developer support cross direction edge. Unlike a developer of claim 13, if the first and second length of the cross direction of developer feed zone material is mutually equal or the developer feed zone material of the developer conveyance direction upstream by developer support is longer, what goes to an edge of developer specification-part material into a developer which blew off from an edge will arise. If the condition that a developer falls on on an edge at which developer support is in contact with developer specification-part material is continued, a developer will go to a crosswise outside along with developer specification-part material, will begin to leak out of a developer, and will pollute the inside of equipment. In a developer of claim 13, since width of face of the contact or the contiguity section is long, a direction where a developer blows off is restricted to the conveyance direction upstream of the above-mentioned developer. [as opposed to developer support in a direction of developer feed zone material located in the conveyance direction downstream of a developer by developer support] In addition, a developer which blew off to the above-mentioned developer conveyance direction upstream returns to a developer stores dept. which **** to this upstream.

[0044] Moreover, in a developer of claim 14, a field across which it faced between the first and second developer feed zone material has a high pressure of a developer, and a developer tends to leak and come out of it to a crosswise outside in an edge of this field. This migration of a developer which is going to leak and come out is regulated by specification-part material on a developer support cross direction outside rather than the first and second developer feed zone material.

(The following, margin)

[0045]

[Embodiment of the Invention] One operation gestalt which applied this invention to the

electrophotography copying machine (henceforth a copying machine) which is image formation equipment hereafter is explained.

[Operation gestalt 1] The schematic diagram of the copying machine which drawing 2 requires for this operation gestalt, and drawing 1 show the abbreviation cross section of the nonmagnetic 1' component developer used for this copying machine. In drawing 2, this copying machine writes in an electrostatic latent image with an aligner 22, after electrifying the photo conductor drum 1 as latent-image support with electrification equipment 21. After that, with a developer 23, development is performed and a toner image is formed on the photo conductor drum 1. A toner image is imprinted on the transfer paper as imprint material by imprint / conveyance member 24 after this, and a transfer paper is fixed to the toner image on a transfer paper with the heat or pressure of an anchorage device 25. The transfer paper with which it was fixed to the toner image is discharged on a paper output tray 26. And the toner of the imprint remainder on the photo conductor drum 1 fails to be scratched with cleaning equipment 27, and is again used for image formation.

[0046] In drawing 1, the toner hopper 6 as a toner stores dept. is formed in the interior of this developer 23. The developing roller 2 as developer support which rotates with the rotational speed of about 220 mm/sec in the drawing Nakaya mark direction The grounded current carrying part 51 and the dielectric section 52 which consists of dielectric materials like the developing roller shown in above-mentioned drawing 9 It has the surface over which it was regularly distributed in minute area, and the minute electric field called the micro field are formed between the toner and the current carrying part in which the charge of reversed polarity was accumulated at this dielectric section 52. And to this developing roller 2, rather than the location where it is a hopper 6 side, and the developing roller 2 is supported to revolve, it is parallel to a developing roller 2, and bottom feed roller 4b which consists of a foaming polyurethane rubber as first developer feed zone material so that it may contact is arranged by the gravity direction lower part. Bottom [this] feed roller 4b is arranged in the condition of having eaten away about 1mm, in the surface of action with a developing roller 2, and the field which contacts mutually moves to hard flow by about 0.8X of the rotational speed of a developing roller 2. Furthermore, to the developing roller 2, rather than the location where it is a hopper 6 side, and the developing roller 2 is supported to revolve, it is parallel to a developing roller 2, and feed roller when consisting of foaming polyurethane rubber as second developer feed zone material so that it may contact 4a is arranged also in the gravity direction upper part. besides, in a surface of action with a developing roller 2, feed roller 4a is consumed about 0.8mm, and is ***** -- it is arranged in the condition and the field which contacts mutually moves in this direction by about 1.2X of the rotational speed of a developing roller 2. Moreover, the lamination blade 3 which has elasticity is in contact with the developing roller 2 from trailing by field contact as developer specification-part material to rotation of a developing roller 2.

[0047] The toner 7 in the above-mentioned hopper 6 is sent to a developing-roller 2 side by the agitator 5, as the arrow head of void among drawing 3 shows, it moves, and it is incorporated from between top feed roller 4a and bottom feed roller 4b. It is top feed roller 4b's contacting a developing roller 2, and rotating, and the dielectric section 52 of a developing roller 2 and frictional electrification of a toner 7 are performed, and the electrified toner 7 is supported by the multilayer on a developing roller 2 by the minute close electric field on a developing roller 2. And to rotation of a developing roller 2, the free end of the lamination blade 3 contacts a developing roller 2, is accustomed to proper toner thickness, and is conveyed in a development region. And development is performed by transferring a toner 7 to the photo conductor drum 1 on which the latent image was written in with the above-mentioned aligner 22. On the other hand, bottom feed roller 4b scratches the toner 7 on the developing roller 2 after ending development, carries out frictional electrification of the toner 7 again, and is supplied on a developing roller 2. In addition, the rotational speed of the photo conductor drum 1 is 200 mm/sec, and is rotated in the drawing Nakaya mark direction.

[0048] In this operation gestalt, the toner 7 sent by the agitator 5 among the vertical feed rollers 4b and 4a from the hopper 6 always builds toner **** with the above-mentioned developer 23 between them. For this reason, even if it forms a solid image continuously, since a toner 7 is always supplied on these

toner ***** developing rollers 2, the fall of the image concentration depended insufficient [toner supply] does not arise. Moreover, since the toner 7 which is going to enter into the lower part of the lamination blade 3 by rotation of top feed roller 4a is returned to a hopper 6 side, the necessity of a toner 7 stopping collecting on the lower part of the lamination blade 3, and forcing the lamination blade 3 on a developing-roller 2 side with strong contact pressure is lost, and toner thickness can always be kept constant using the lamination blade 3 of a simple device. In order to prevent toner scattering from a developer 23, it becomes unnecessary furthermore, to form the seal member 10 in the developing-roller 2 lower part, in order that the toner 7 of the lower part of bottom feed roller 4b may also move so that it may return to a hopper 6 side by rotation of bottom feed roller 4b. In addition, although the seal member 10 is formed in preventing toner scattering certainly in the example of drawing 1, since it becomes unnecessary to make it stick to a developing roller 2, the configuration can be simplified.

[0049] A concrete development components property and the development conditions are as follows.

(1) Lamination blade 3 and the quality of the material Polyurethane rubber and thickness The blade length to 2mm and the free end The amount of blade interlocking to 11mm and a roller The amount of ejection from 0.6mm and the blade contact section to the free end A schematic diagram is shown in 0.5mm(2) developing-roller 2 (creation method) drawing 4.

- By the knurling tool type, the diameter of a roller is 20mm and performs iris knurling tool processing to aluminum rodding at the angle of 45 degrees with 0.3mm pitch, a depth of 0.1mm, and the flute width of 0.2mm.

- A dielectric layer coat coats epoxy denaturation silicone resin (Toray Industries SR2115), and dries it at 50 degrees C for about 90 minutes.

- Cut the roller surface and expose the aluminum side 51 and the dielectric side 52 at a rate of 3:7.

(3) feed roller 4 and material: -- carbon kneading lump foaming polyurethane sponge roller top feed roller: -- 16mm of diameters Interlocking bottom feed roller [of 1mm]: -- 14mm of diameters Interlocking 0.8mm(4) development gap and 150 micrometers (a photo conductor uses a drum type) development bias and direct-current-750V(5) photo-conductor drum 1 and photo conductor class: -- OPC and surface potential: -- the natural complexion section -850 -- minus electrification toner volume mean-particle-diameter: 10micrometer and external additive: hydrophobic silica impalpable powder of V and write-in section (image section)-100V(6) toner 7 and nonmagnetic styrene acrylic + polyester system resin use 0.7wt% -- addition [0050] Here, top feed roller 4a and bottom feed roller 4b are contacted to a developing roller 2, respectively, it arranges, and toner ***** is built with the equipment shown in drawing 1 by the field surrounded with top feed roller 4a, bottom feed roller 4b, and a developing roller 2. However, since a toner 7 is sent into this toner ***** one after another, it is required to make it move to the toner conveyance direction downstream to some extent, and to circulate a toner 7 within a development counter. And for that, it is desirable that it is easy to move a toner 7 through the contact section of top feed roller 4a and a developing roller 2. Then, the foaming member used for top feed roller 4a is made as soft as possible, and since it is necessary to fail to scratch the toner 7 on a developing roller 2, the foaming member used for bottom feed roller 4b is hardened as much as possible. Specifically as a foaming member used for equipment top feed roller 4a like drawing 1, and bottom feed roller 4b, the thing of about three 10 - 30 kg/cm density is suitable for top feed roller 4a to the thing of about three 35 - 65 kg/cm density, and bottom feed roller 4b, for example.

[0051] By using the feed rollers 4a and 4b from which such foaming density differs After a toner 7 is consumed by development, while being able to erase the hysteresis of development to some extent by scratching the toner 7 which remained on the developing roller 2 by bottom feed roller 4b Since the desired amount of toners can be certainly supplied on a developing roller 2 in one toner supply actuation by top feed roller 4a when the toner 7 of the above-mentioned toner ***** moves through the contact section of top feed roller 4a and a developing roller 2, the hysteresis of development can be erased certainly. Therefore, each function of the vertical feed rollers 4b and 4a can be demonstrated enough. Moreover, since it is made to circulate so that a load with the toner 7 superfluous to the above-mentioned lamination blade 3 in a development counter may not be applied, the configuration of the lamination blade 3 can be simplified. Moreover, also in the equipment which has formed the seal

member 10, since it is made to circulate so that a superfluous load may not be applied to the seal member 10, the structure of the seal member 10 can be simplified.

[0052] Drawing 5 is the outline cross section showing the modification of drawing 1. The fundamental configuration is the same as that of drawing 1, and it differs in that the vertical feed rollers 4b and 4a were set as mutually different conditions. Hereafter, this point is explained.

[0053] Drawing 6 (a) and (b) show the contact section of the developing roller 2 when arranging both the rollers 4a and 4b so that the amount of interlocking of feed roller when developing roller 2 is received 4a may become larger than the amount of interlocking of bottom feed roller 4b, and bottom feed roller 4b, and the contact section of a developing roller 2 and top feed roller 4a in the developer 23 of drawing 5, respectively. Bottom feed roller 4b shown in drawing 6 (a) here Although it is desirable to make it eat into a developing-roller 2 side to some extent in order to scratch the toner 7 which remained on the developing roller 2 after development Since the problem that a driving torque load will increase will arise if the amount of interlocking to a developing roller 2 is enlarged too much, It is desirable to set a toner 7 as the amount of interlocking of the degree which can be scratched enough, and when foaming polyurethane is used for a feed roller like this operation gestalt, it is desirable to decide the location of bottom feed roller 4b so that it may become the range of 0.4-0.75mm. On the other hand, feed roller when shown in drawing 6 (b) 4a From it being necessary to make frictional electrification and the toner coating weight before blade passage optimize, when the contact surface with a developing roller 2 moves in this direction mutually and a toner 7 passes this nip section It is desirable to make it larger than the amount of interlocking of bottom feed roller 4b, and it is desirable to decide the location of top feed roller 4a so that it may become the range of 0.8-1.5mm with this operation gestalt. Thereby, each function of the vertical feed rollers 4b and 4a can be demonstrated enough. Moreover, when the driving torque of the developer 23 in the case of four a1 top feed roller was measured, to having been 1.0 - 1.2 kgf/cm, in this operation gestalt which added bottom feed roller 4b, it is a 1.5 kgf/cm degree, and the increment in driving torque was able to be suppressed low. Moreover, generating of vibration by the contact to the developing roller 2 of the vertical feed rollers 4b and 4a etc. could be suppressed, and it was checked that a smooth drive is possible.

[0054] Moreover, each function of the vertical feed rollers 4b and 4a can be enough demonstrated also by [which are different in the thickness of the above-mentioned vertical feed rollers 4b and 4a] setting up thickly. That is, in bottom feed roller 4b shown in drawing 6 (a), since the property as an elastic body of a foaming member is seldom required, it is desirable for it not to be necessary to also thicken the thickness and to make it into the thickness of 2.0-3.5mm with the equipment of this operation gestalt. In case a toner 7 is passed through the contact section with a developing roller 2 in feed roller after being shown in drawing 6 (b) 4a, in order to make it desired frictional electrification and toner thickness on the other hand, it is required to make it make it stick with a developing roller 2 as much as possible, and since a certain amount of elastic force is required, it is desirable to make it the thickness of 4-6mm with the equipment of this operation gestalt.

[0055] Moreover, in the contact section with a developing roller 2, in order that bottom feed roller of the above 4b may move in the direction in which the contact surfaces differ mutually and may fail to scratch the toner 7 on a developing roller 2 with a big linear-velocity difference, when deflection, a deflection, etc. of shaft 41b of bottom feed roller 4b arise, it has a possibility that contact of the nip section may become unstable. On the other hand, in the contact section with a developing roller 2, top feed roller 4a has a light drive load compared with bottom feed roller 4b, in order that the contact surface may move in the same direction mutually, and in shaft 41a of top feed roller 4b, neither deflection nor a deflection can produce it easily. For this reason, with this operation gestalt, while setting the shaft diameter of shaft of bottom feed roller 4b to 7mm or more, the shaft diameter of shaft 41a of top feed roller 4b can be set to 6mm or less.

[0056] If the linear velocity of the vertical feed rollers 4b and 4a to a developing roller 2 is set up here so that it may become quicker than a developing roller 2, the amount of toners conveyed by toner **** surrounded with the vertical feed rollers 4b and 4a and a developing roller 2 increases, and since the amount of toners which passes the nip section of top feed roller 4b and a developing roller 2 increases, a

toner 7 will be superfluously supplied to a developing roller 2. And when a toner 7 is superfluously supplied to a developing roller 2, there is a possibility that it may be connected with toner scattering and development nonuniformity by the toner 7 in short of electrification. On the contrary, when linear velocity of the vertical feed rollers 4b and 4a to a developing roller 2 is made too much later than a developing roller 2, the toner 7 which sufficient toner supply becomes impossible in top feed roller 4b, and it failed to scratch from a developing roller 2 in bottom feed roller 4a becomes that it is hard to be returned to the toner hopper 6 side, and will cover a superfluous load over the above-mentioned seal member 10. Then, the linear velocity ratio of the vertical feed rollers 4b and 4a to a developing roller 2 the degree in which a toner 7 does not adhere a maximum to a developing roller 2 superfluously -- while carrying out to below actual size desirably, the minimum It is desirable to set it as the degree which returns the degree which can perform toner supply sufficient about top feed roller 4b for a developing roller 2, and the toner 7 which it failed to scratch from a developing roller 2 about bottom feed roller 4a to the toner hopper 6 side, and does not require a superfluous load for the above-mentioned seal member 10. Thus, each function of the vertical feed rollers 4b and 4a can be enough demonstrated also by setting up the linear velocity ratio of each feed roller so that each linear velocity ratios of the vertical feed rollers 4b and 4a to a developing roller 2 may differ mutually.

[0057] The conditions of the concrete feed roller concerning a modification are as follows. In addition, since it is the same as that of the developer of drawing 1, other conditions are omitted.

Top feed-roller 4a and a material: A carbon kneading lump foaming polyurethane sponge roller and foaming density 25kg/cm³ and the diameter of a roller : [16mm,] shaft diameter: -- 6mm sponge thickness: -- amount of interlocking: to 5mm and a developing roller 2 -- linear velocity ratio: to 1mm and a developing roller 2 -- bottom feed roller of 0.8 times (rotation of developing roller 2 is this direction) 4b, and material: -- a carbon kneading lump foaming polyurethane sponge roller and foaming density 40 kg/cm³ and diameter of roller: -- 13mm and shaft diameter: 8mm sponge thickness: -- amount of interlocking: to 2.5mm and a developing roller 2 -- linear velocity ratio: to 0.5mm and a developing roller 2 -- 0.5 times (rotation of a developing roller 2 is hard flow)

[0058] [Operation gestalt 2] Next, other operation gestalten are explained using drawing 7. Although the same developer as the operation gestalt 1 and development components are used with this operation gestalt, the agitator 8 which the amount of this shank consists of four-sheet feather is attached instead of feed roller 4a of the bottom which consists of foaming polyurethane. Since the toner 7 which is going to enter into the lower part of the lamination blade 3 by rotation of an agitator 8 is returned to a hopper 6 side according to this, the necessity of a toner 7 stopping collecting on the lower part of the lamination blade 3, and forcing the lamination blade 3 on a developing-roller 2 side with strong contact pressure is lost, and toner thickness can always be kept constant using the lamination blade 3 of a simple device. Moreover, fixed concentration is obtained, without the toner amount of supply running short, even if it carries out continuation formation of the solid image since toner **** is always formed between lower feed roller 4b and an agitator 8. Moreover, since a toner 7 stops easily being able to collect on the seal member 10 of the lower part of the lamination blade 3, and the developing-roller 2 lower part, the image stabilized using the seal member 10 of easy structure can be formed. In addition, the same effect can be acquired even if it attaches and constitutes the brush roller which the amount of [of an agitator 8] shank consists of polyester fiber instead of an agitator 8.

[0059] [Operation gestalt 3] Next, the operation gestalt of further others is explained using drawing 8. Although the same developer as the operation gestalt 1 and development components are used with this operation gestalt, the agitator 8 which the amount of this shank consists of four-sheet feather is attached instead of bottom feed roller 4b which consists of foaming polyurethane. According to this, since toner **** is always formed between top feed roller 4a and an agitator 8, fixed concentration is obtained even if it carries out continuation formation of the solid image. Moreover, since a toner 7 stops collecting on the seal member 10 of the lower part of the lamination blade 3, and the developing-roller 2 lower part, the image stabilized using the seal member 10 of easy structure can be formed. In addition, the same effect can be acquired even if it attaches and constitutes the brush roller which the amount of [of an agitator 8] shank consists of polyester fiber instead of an agitator 8 like the above-mentioned operation

gestalt 2.

[0060] [Operation gestalt 4] Next, the operation gestalt of further others is explained using drawing 9 and drawing 10. With this operation gestalt, it has the same configuration as the operation gestalt 1 fundamentally. As shown in drawing 9 (a), the vertical feed rollers 4a and 4b which contact and rotate to a developing roller 2 are rotating so that the toner by the side of a hopper 6 may be supplied to a developing-roller 2 surface side through between both rollers: k void arrow head A in drawing 9 (b) shows the toner migration from the toner hopper side of a between [both rollers]. Moreover, all over this drawing, the arrow head of void also shows toner migration near both the rollers. As a function of bottom feed roller 4b located in the upstream of a toner stratification production process, the non-charged toner in a hopper is conveyed to up to a developing roller 2, it is failed to write the toner on a developing roller 2 with the contact section, and the toner of developing-roller 2 lower part is further returned to a hopper side. Moreover, the toner which is not charged [which performed regulation to the coating weight of frictional electrification and optimum dose through the contact section with a developing roller 2, and entered into lamination blade 3 lower part the toner of the field caught in the up-and-down feed roller as a function of feed roller when located in lower stream of a river of toner stratification production process 4a] is again returned into a hopper.

[0061] In order to attain such a function good, it is good to make into the range of 0.2-2mm the shortest gap t of two feed rollers 4a and 4b shown in drawing 10. This is based on the following reason. That is, the inflow of the toner in a hopper to the field (the drawing 10 slash section) inserted into these vertical feed rollers 4a and 4b and a developing roller 2 as the shortest gap between two above-mentioned feed rollers is 0.2mm or less is regulated few. For this reason, when toner consumption inclines toward one side by the longitudinal direction of a developing roller 2, it is easy to produce the deviation of this amount of toners in slash section space, and the toner amount of supply tends to become an ununiformity over developing-roller 2 longitudinal direction. Moreover, if the shortest gap of two above-mentioned feed rollers 4a and 4b is set to 2mm or more, a flow which the toner which once flowed into the above-mentioned slash section space leaves from this shortest gap again will arise, and the density of the toner in this slash section space will not increase enough. For this reason, the pressure to which a toner tends to pass through between a feed roller and developing rollers 2 will be low, and the toner coating weight to a developing roller 2 will become unstable. Thus, since the toner density in this slash section space of drawing 10 is kept stable when the shortest gap of two above-mentioned feed rollers 4a and 4b is set as the range of 0.2-2mm, reflux of the toner which toner adhesion recovered after solid development promptly, and was shown by the void arrow head of drawing 9 (b) is performed good, and facilitation of a lamination blade 3 toner regulation device or a bottom seal device is attained.

[0062] In addition, in the example of illustration, partition section 6a extended from the bottom case upper surface is formed between a toner hopper side and bottom feed roller 4b.

[0063] Drawing 11 is explanatory drawing of the example of amelioration of the developer concerning this operation gestalt. In this example of amelioration, two feed rollers 4a and 4b which contact and rotate to a developing roller 2 are set as respectively different potential at the time of development, and it has become a potential setup which supplies a use toner to the top [b / bottom feed roller 4] feed roller 4a side with voltage impression equipment. This sends into the down-stream region top feed roller 4a side only the toner (here, it subtracts) charged in normal in the field inserted into two feed rollers 4a and 4b, and the toner charged in being un-charged or reversed polarity (here, it adds) is making the opportunity to contact, make rub against a feed roller and a developing roller 2 by sending to the bottom feed roller of the upstream region 4b side, and to be charged in normal increase. When it does in this way, even when the amount of electrifications of a toner is low, as for a non-charged toner etc., a toner layer has few ** people under humid environment etc., and the toner which disperses out of a development unit from the toner layer surface as a result can be reduced. and -- even if a developing-roller 2 top toner is consumed in ** TA development etc. -- prompt -- toner adhesion -- recovering -- always - the degree of ***** of a law is obtained.

[0064] Drawing 12 is explanatory drawing of other examples of amelioration. He is trying for the direction of feed roller as [shown in drawing 12 (b)] and when contact length of longitudinal direction

of two feed rollers a [4] and 4b which contact and rotate to developing roller 2 is located down-stream from bottom feed roller 4b located in the upstream 4a to become long in this example. The portion shown with the slash in each feed roller is a contact portion with a developing roller 2. The pressure of a toner is high and, as for the field across which it faced between two feed rollers 4a and 4b, a toner tends to blow off in an edge. The arrow head shows the sense to which a toner progresses. Unlike this example of amelioration, the length of the longitudinal direction of two feed rollers 4a and 4b is equal like drawing 12 (a), or if the bottom feed roller 4b which is in a bottom location and is located in the upstream of conveyance of a toner is longer, what goes to lamination blade 3 upper edge as a direction of a blowoff of the toner from an edge will arise. If the condition that a toner falls on on the edge at which the developing roller 2 is in contact with the lamination blade 33 is continued, a toner will begin to leak out of a development unit at the sense of the void arrow head E shown in drawing 13 ; and the inside of equipment will be polluted. If contact length [as opposed to a developing roller 2 in the direction of feed roller when it is located in lower stream of a river of toner conveyance like drawing 12 (b) unlike this 4b] is long, the direction where a toner blows off becomes downward, and leakage **** of a toner can be prevented from lamination blade 3 edge. bottom feed-roller 4b moreover, boil the toner which blew off to the down side -- since it is returned to a ***** toner hold machine side and is agitated -- a unit edge -- a toner -- **** -- there is no thing [like].

(The following, margin)

[0065] In addition, leakage **** of a toner can be prevented by putting the seal member 61 of sponge between the contact section to the developing roller 2 of a blade edge, and that of the lamination blade 3, as shown in drawing 14 .

[0066] Drawing 15 is explanatory drawing of the example of amelioration of further others. in this example, it has the seal member 60 contacted and pressed at the edge of a developing roller 2, and is shown in drawing 15 (b) -- as -- the length L2 of the hoop direction of this seal member 23 -- this -- two feed rollers 4a and 4b -- he is trying to become longer than the hoop direction length LI of the pinched portion. The pressure of a toner is high, and the toner is going to leak and come out of the field across which it faced between two feed rollers 4a and 4b as this showed drawing 12 to the longitudinal direction side in an edge. In order to prevent this, as shown in drawing 15 (a), to developing-roller 2 edge, it contacts and the seal member 23 is pressed. Since a seal member exists in the direction from which a toner tends to leak at this time, as shown in the cross section of drawing 15 (b), the seal member 60 covers the field inserted into two feed rollers 4a and 4b. The leakage of the toner from an edge can be prevented to **** by doing in this way.

[0067]

[Example 1] Hereafter, the example of the operation gestalt 4 is explained. In the developer shown in drawing 9 (a), the speed of a photo conductor 1 is 200 mm/sec, and was rotated clockwise. Developing rollers 2 are about 210 mm/sec, and were rotated counterclockwise. The shortest gap t of the vertical feed rollers 4a and 4b was set as 1.5mm.

[0068] Another concrete development components property and other development conditions are as follows.

(1) Lamination blade 3 and the quality of the material Polyurethane rubber and thickness The blade length to 2mm and the free end The amount of blade interlocking to 11mm and a roller The amount of ejection from 0.6mm and the blade contact section to the free end A schematic diagram is shown in 0.5mm(2) developing-roller 2 (creation method) drawing 4 .

- By the knurling tool type, the diameter of a roller is 20mm and performs iris knurling tool processing to aluminum rodding at the angle of 45 degrees with 0.3mm pitch, a depth of 0.1mm, and the flute width of 0.2mm.

- A dielectric layer coat coats epoxy denaturation silicone resin (Toray Industries SR2115), and dries it at 50 degrees C for about 90 minutes.

- Cut the roller surface and expose the aluminum side 51 and the dielectric side 52 at a rate of 3:7.

(3) bottom feed roller 4a and material: -- carbon kneading lump foaming polyurethane sponge roller roller: -- 13mm of diameters sponge thickness: -- 3mm of diameters, and interlocking: -- 0.5mm and pair

developing-roller linear velocity ratio: -- 0.5X (inverse rotation)

(4) top feed roller 4b and material: -- carbon kneading lump foaming polyurethane sponge roller roller: -- 13mm of diameters sponge thickness: -- 3mm of diameters, and interlocking: -- 1mm and pair developing-roller linear velocity ratio: -- 0.8X (order rotation)

(5) A development gap, 150 micrometers (a photo conductor uses a drum type)

development bias and direct-current-750V(6) photo-conductor drum 1 and photo conductor class: --

OPC and surface potential: -- the natural complexion section -850 -- minus electrification toner volume mean-particle-diameter: 10micrometer and external additive: hydrophobic silica impalpable powder of V and write-in section (image section)-100V(7) toner 7 and nonmagnetic styrene acrylic + polyester system resin use 0.7wt% -- addition [0069] According to the above-mentioned example 1, it changed into the condition that supply **** of a toner always arises in the space inserted into two feed rollers and a developing roller. For this reason, even if it formed the solid image continuously, the fall of the image concentration depended insufficient [toner supply] was not produced. Moreover, a toner did not collect under the lamination blade 3, but toner thickness was always able to be kept constant with the simple blade. Moreover, the flow which returns a toner to a hopper side arose, and especially the seal member was more nearly unnecessary than bottom feed roller 4b also in the lower part of a developing roller 2.

[0070]

[Example 2] Although the same development counter as an example 1 and development components are used, -750V and bottom feed roller 4b potential are set as -950V for developing-roller 2 potential at the time of development. Top feed roller 4b is a developing roller 2 and this potential. And although photo conductor and developing-roller 2 linear velocity was raised to 330 mm/sec and image formation was performed, scattering of a toner to lamination blade arm-top-cover 6b of drawing 10, YUNITTOAGO section 6c under a developing roller, etc. was almost equivalent to the time of linear velocity 200 mm/sec. Thus, since toner scattering is reduced, production of the image formation equipment of high speed is attained. Moreover, the effect that it reduced the same scattering even if feed roller 4b makes it the conditions whose feed roller 4b is -650V the bottom, setting developing-roller 2 potential to -750V was acquired -850V and a top.

[0071]

[Example 3] Although the same development counter as an example 1 and development components are used, the edge length of the sponge portion of bottom feed roller of lower location 4b is short about 2mm from upper location top feed roller 4b. Thus, the blowoff of the toner to the upper part in the edge between the feed rollers 4a and 4b of these two books was not able to occur the bottom at the time, but leakage **** of a toner was able to be prevented by putting the seal member 61 of sponge between the contact section to the developing roller 2 of a blade edge, and that of the lamination blade 3, as shown in drawing 14.

[0072]

[Example 4] Although the same development counter as an example 1 and development components are used, the length of the longitudinal direction of a developing roller 2 is longer than the sponge length of the feed rollers 4a and 4b of these two books, and the hair brush-like seal member is in contact with this developing-roller end section. and the length of circumferential 10,000 ** of this seal member is shown in drawing 15 (b) -- as -- this -- the circumferential 10,000 ** length halfbeak of the field inserted into two feed rollers 4a and 4b -- long -- this field -- a wrap -- it is like. for this reason -- this -- even if the blowoff of the toner to the direction of an edge of a developing roller 2 arose with the toner conveyance pressure of two feed rollers 4a and 4b, the leakage broth of a toner could be prevented, and it became possible to use a development counter over a long period of time.

[0073] As mentioned above, according to the developer of each operation gestalt, a good image can be continued and obtained, without toner scattering and the image greasing by the toner 7 in short of electrification occurring.

[0074]

[Effect of the Invention] Since the developer which was not supported on this developer support after a

developer's passing the opposite section of the second developer feed zone material and this developer support moves to this developer reservoir side according to the developer of claim 1. It differs from the case where the developer has piled up above this second developer feed zone material. It is prevented that a developer enters superfluously between this developer support and this developer specification-part material, and lamination only of the developer regulated by desired thickness between this second developer feed zone material and this developer support is further carried out by this developer specification-part material. Thereby, as compared with equipment, the structure for maintaining the contact pressure of this developer specification-part material to this developer support can be simplified conventionally. Moreover, since the developer with which this first developer feed zone material failed to be caudad scratched by this first developer feed zone material moves in the surface of action of this developer support and this first developer feed zone material so that it may return to this developer stores dept. side. There is no possibility that a developer may disperse out of a developer in the lower part of this developer support, and it becomes unnecessary to prepare the seal member which prevents developer scattering unlike the case where the developer has piled up under this lower second developer feed zone material.

[0075] According to the developer of claim 2, especially by always forming developer **** between the above-mentioned first developer feed zone material. Even if a developer is certainly supplied to this developer ***** these developer support, for example, a developer is consumed so much by solid development, it becomes without the developers supplied on this developer support after solid development not running short, and the hysteresis of development remaining on this developer support.

[0076] Moreover, since according to the developer of claim 3 it conveys so that the developer which passed through between a developer conveyance member and developer support, and moved above this developer conveyance member may be smoothly returned to this developer reservoir side. Unlike a case so that a developer may pile up in the upper part of this developer conveyance member, it can prevent being stuffed between developer specification-part material and this developer support surface, and the structure of developer specification-part material can be simplified.

[0077] Moreover, since according to the developer of claim 4 the developer with which it passes through between a developer conveyance member and developer support, and this developer conveyance member failed to be scratched caudad is conveyed so that this developer conveyance member may return to this developer reservoir side smoothly, the developer with which this developer conveyance member failed to be scratched caudad cannot pile up as it is, and developer scattering from a development counter can be prevented. It becomes unnecessary therefore, to prepare the seal member for developer scattering prevention in the lower part of this developer support.

[0078] Moreover, according to the developer of claim 5, since a developer can be held in the foaming cel of foaming resin, by the first developer feed zone material, scraping effectiveness can improve and generating of the development hysteresis by poor developer scraping can be prevented. Moreover, since a developer can be held and conveyed in said foaming cel in said second developer feed zone material. Even when the developer supply effectiveness to the contact section with developer support improves and a developer is consumed so much by solid development etc., by one developer supply actuation. A developer can be supplied on said developer support, and frictional electrification of this developer can be performed good, and the low density of a developed image and generating of concentration nonuniformity can be prevented.

[0079] Moreover, according to the developer of claim 6, since driving torque is reduced about the first developer feed zone material, vibration produced when a torque load is large is mitigable. Moreover, since the coating weight on said developer support before developer specification-part material passage is optimized while carrying out frictional electrification of the developer which passes the contact section with the above-mentioned developer support about the second developer feed zone material still more efficiently, the low density of a developed image and generating of concentration nonuniformity can be prevented.

[0080] Moreover, since according to the developer of claim 7 the elastic force of a thick portion is weakened about the first developer feed zone material and the developer scraping effectiveness on the

developer support after development is raised further, generating of the development hysteresis by poor developer scraping can be prevented certainly. Moreover, since it is made to stick elastically on developer support about the second developer feed zone material and developer electrification / supply effectiveness is raised further, the low density of a developed image and generating of concentration nonuniformity can be prevented.

[0081] Moreover, since the deflection and the deflection of a support shaft of the first developer feed zone material which scratch the developer which remained on developer support after development are mitigated according to the developer of claim 8, the low density of a developed image and generating of concentration nonuniformity can be prevented.

[0082] Moreover, since according to the developer of claim 9 it can prevent that a developer is superfluously supplied on this developer support after passing the contact section of developer support and this first developer feed zone material and the developer scraping effectiveness on the developer support after development is further raised by the first developer feed zone material, generating of the development hysteresis by poor developer scraping can be prevented certainly. Moreover, since it can prevent that a developer is superfluously supplied by the second developer feed zone material on this developer support after passing the contact section of said developer support and said second developer feed zone material and developer electrification / supply effectiveness is raised further, the low density of a developed image and generating of concentration nonuniformity can be prevented. Moreover,

[0083] Since the load which the developer which failed to be scratched to this seal member gives is mitigable especially according to the developer of claim 10 while being able to prevent developer scattering out of a developer certainly by preparing a seal member, the seal member of the easy structure where adhesion with this developer support is lower than the seal member conventionally used for equipment can be used.

[0084] According to claim 11 thru/or the developer of 14, predetermined ***** is produced in the field surrounded by both the above-mentioned developer feed zone material and developer support. Since it enables it to perform frictional electrification of the developer between both developer feed zone material or developer support good Also when electrification equalization of a developer layer and the formation of thickness fixed on developer support can be attained, for example, a latent image with much developer consumption, such as a latent image of a poor image, is developed, the fall of the development image concentration by supply of the electrification toner to a developer support top stopping fulfilling demand can be prevented in the next development. Moreover, since the developer with which conveyance to a development field was regulated by the above-mentioned developer specification-part material is returned to a developer stores dept. side by the developer feed zone material of the developer conveyance direction downstream by the above-mentioned developer support among the above 1st and the 2nd developer feed zone material As compared with the equipment with which a developer enters superfluously between developer support and this developer specification-part material, the structure for maintaining the contact pressure of this developer specification-part material to developer support can be simplified. Moreover, since the developer which failed to be scratched by the developer feed zone material of another side, for example is returned to a developer stores-dept. side by the developer feed zone material of this another side from the development support surface portion which passed through the development field and has returned in a development counter, the configuration of a seal member for the developer which failed to be scratched the account of a top to prevent developer scattering as compared with the equipment which piles up as it is can be simplified, or such a seal member itself can be omitted.

[0085] According to the developer of claim 11, especially by setup of the closest-approach gap in the opposite field of the above-mentioned first developer feed zone material and the second developer feed zone material While the amount of supply developers to the above-mentioned developer support maintains at homogeneity by the above-mentioned developer support longitudinal direction Since the amount of developers which adheres to the developer support surface and passes the contact or the contiguity section of the developer feed zone material of the developer conveyance direction downstream by developer support among the above 1st and the 2nd developer feed zone material can be

stabilized Electrification equalization of a developer layer and the formation of thickness fixed on developer support can plan to fitness further.

[0086] Moreover, since the developer charged in desired polarity is intensively conveyed to a developer specification-part material side promptly by the above 1st by the voltage impression means, and predetermined electric-field formation of a between [the 2nd developer feed zone material] according to the developer of claim 12 also when a developer support top developer is quickly consumed in the development of a ** TA image latent image etc., the developer coating weight on developer support is recovered promptly -- making -- always - the degree of ***** of a law can be obtained. Moreover, the developer which a developer layer has under the environment where it is [of humidity] high etc. as for ** people, such as a non-charged developer, even when the amount of electrifications of a developer is low since it is made to convey to a developer specification-part material side after the developer charged in being un-charged or reversed polarity by electric-field formation predetermined [above-mentioned] is charged in desired polarity, and disperses out of the developer layer surface to a developer as a result can be reduced. [few] Therefore, even if it carries out high-speed rotation of the developer support which supported the multilayer developer layer, for example, developer scattering does not increase but it can use for the image formation equipment of high speed.

[0087] By moreover, setup of contact width of face [as opposed to / according to the developer of claim 13 / this developer support of the 1st and 2nd developer feed zone material], or contiguity width of face Since the direction of the developer which blows off outside in a developer support cross direction edge is restricted to the developer conveyance direction upstream by developer support from the field where the pressure of the developer inserted between both developer feed zone material is high, leakage **** of the developer from a developer specification-part material edge can be prevented.

[0088] Moreover, since migration of the developer with which the pressure of the developer inserted between the first and second developer feed zone material tends to leak and come out from a high field to a crosswise outside is regulated by specification-part material according to the developer of claim 14, the leakage broth of the developer from a development developer support edge can be prevented.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The outline block diagram of the developer concerning an operation gestalt.

[Drawing 2] The outline block diagram of the image formation equipment which can apply this invention.

[Drawing 3] The enlarged view of the developing-roller circumference of this developer.

[Drawing 4] (a) And (b) is explanatory drawing of the developing roller of this developer.

[Drawing 5] The outline block diagram of the developer concerning a modification.

[Drawing 6] (a) is the enlarged view of the contact section of a developing roller and a bottom feed roller. (b) is the enlarged view of the contact section of a developing roller and a top feed roller.

[Drawing 7] Explanatory drawing of the developer concerning other operation gestalten.

[Drawing 8] Furthermore, explanatory drawing of the developer concerning other operation gestalten.

[Drawing 9] (a) is explanatory drawing of the developer concerning the operation gestalt of further others. (b) is explanatory drawing of toner migration within this developer.

[Drawing 10] Explanatory drawing of the feature section of this developer.

[Drawing 11] Explanatory drawing of the example of amelioration of this developer.

[Drawing 12] (a) is explanatory drawing of toner migration within this developer. (b) is explanatory drawing of other examples of amelioration of this developer.

[Drawing 13] Explanatory drawing of toner migration within this developer.

[Drawing 14] Explanatory drawing of the example of amelioration of further others of this developer.

[Drawing 15] (a) And (b) is explanatory drawing of the example of amelioration of further others of this developer.

[Drawing 16] (a) And (b) is explanatory drawing of the developing roller concerning the conventional example.

[Drawing 17] Explanatory drawing of the developer concerning the conventional example.

[Drawing 18] Explanatory drawing of the developer concerning other conventional examples.

[Description of Notations]

1 Photo Conductor Drum

2 Developing Roller

3 Lamination Blade

4a Top feed roller

4b Bottom feed roller

5 Agitator

6 Toner Hopper

7 Toner

8 Agitator

10 Seal Member

21 Electrification Equipment

22 Aligner

23 Developer
24 Imprint / Conveyance Member
25 Anchorage Device
26 Paper Output Tray
27 Cleaning Equipment
41a Top feed roller shaft
41b Bottom feed roller shaft
51 Current Carrying Part
52 Dielectric Section
t Closest-approach section gap
60 Seal Member

[Translation done.]

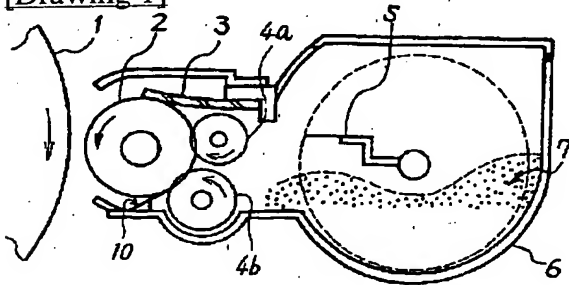
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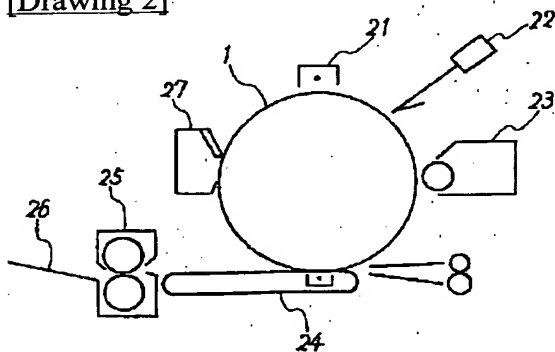
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DRAWINGS

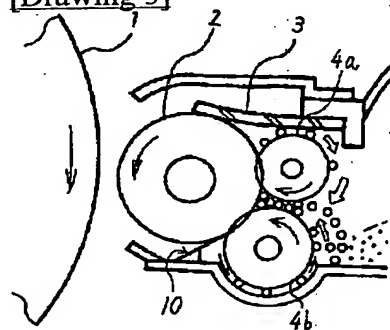
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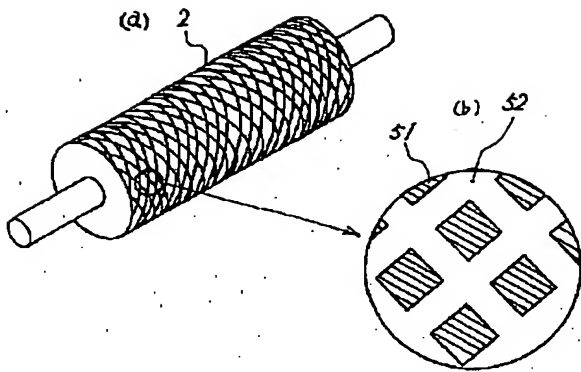
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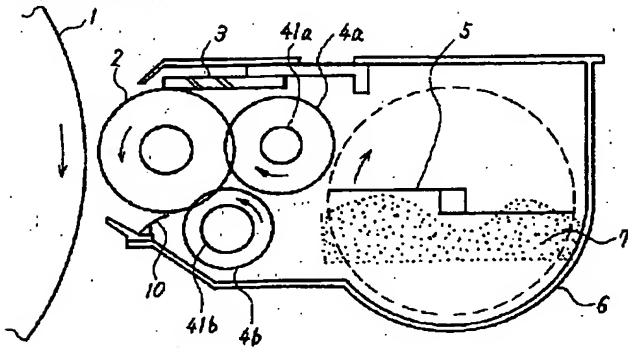
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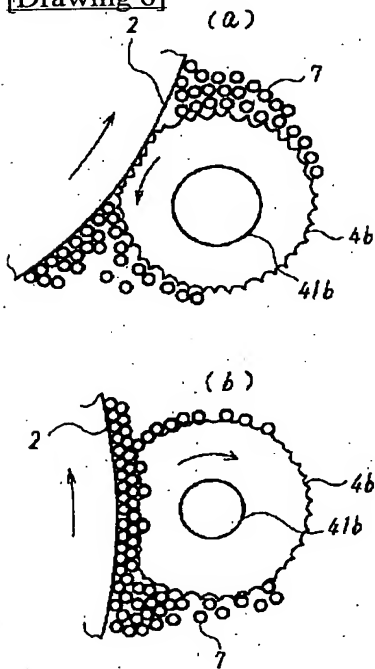
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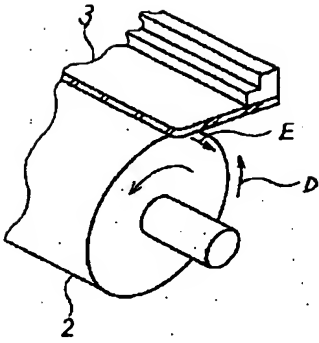
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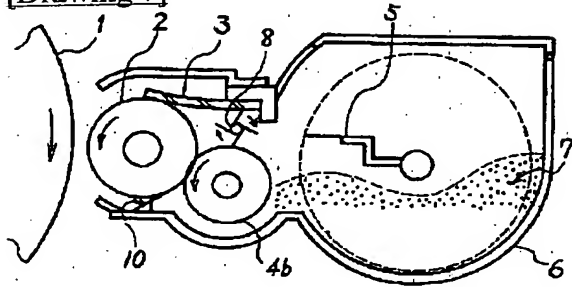
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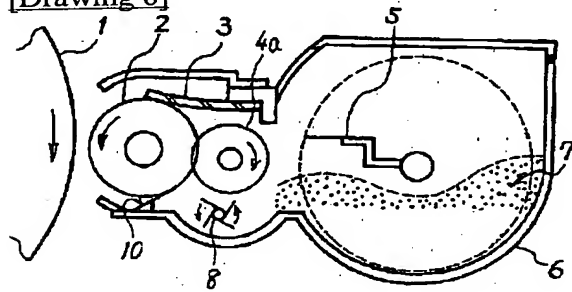
[Drawing 13]



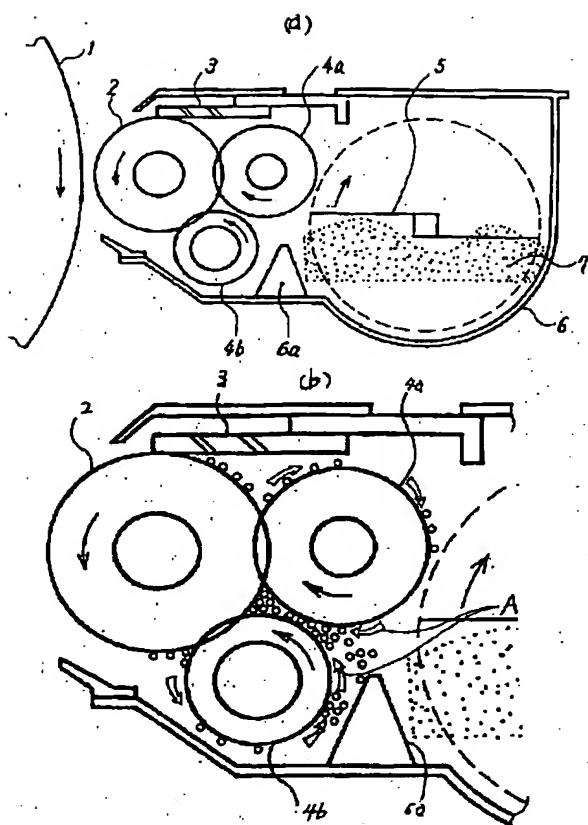
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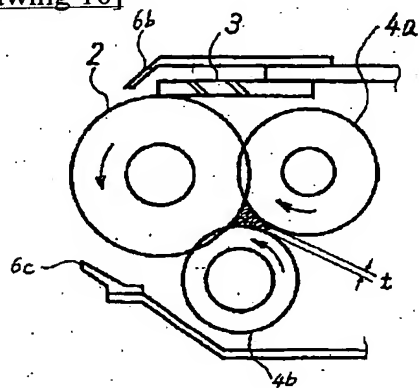
[Drawing 8]



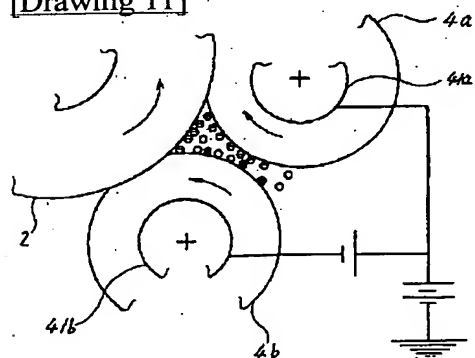
[Drawing 9]



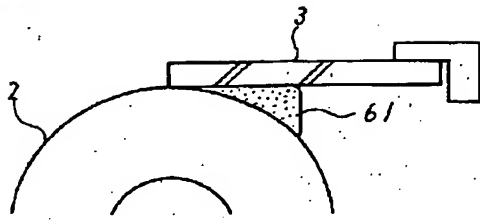
[Drawing 10]



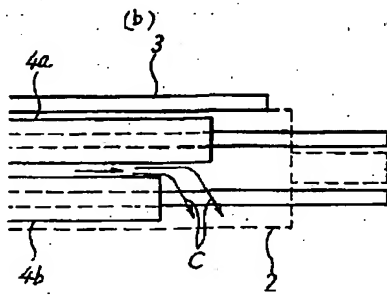
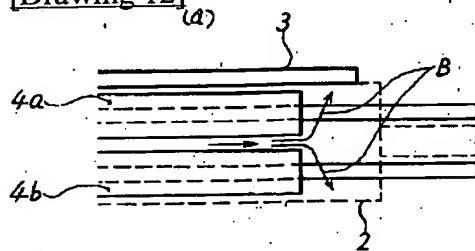
[Drawing 11]



[Drawing 14]

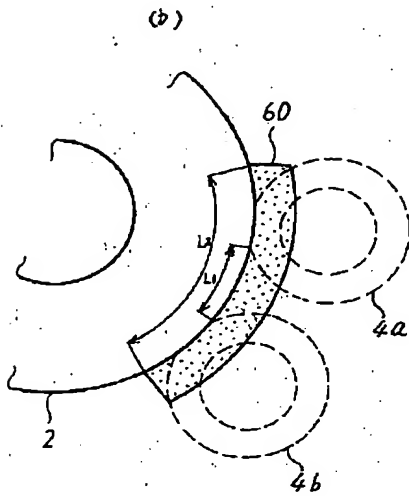
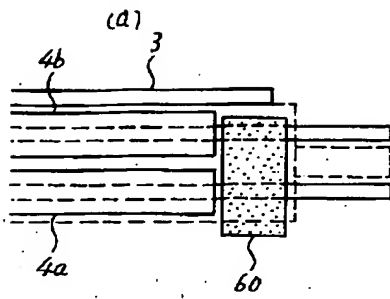


[Drawing 12]

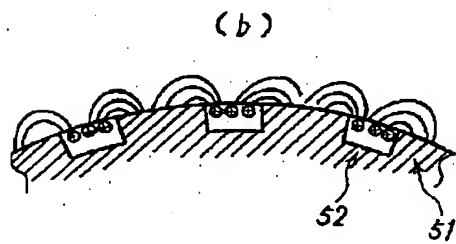
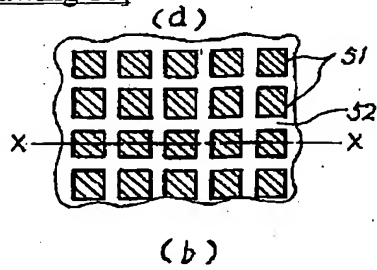


[Drawing 15]

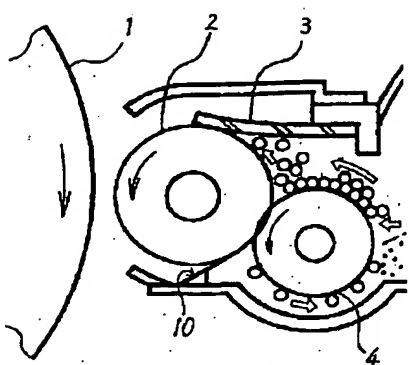




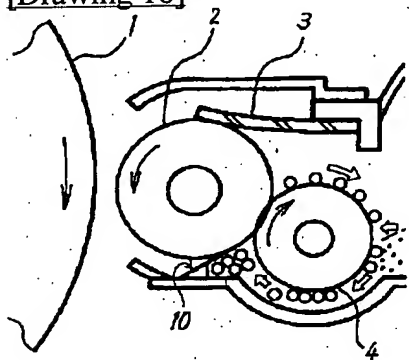
[Drawing 16]



[Drawing 17]



[Drawing 18]



[Translation done.]

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(71) 出願人 000006747

株式会社リコー

東京都大田区中馬込1丁目3番6号

(72) 発明者 岩田 尚貴

東京都大田区中馬込1丁目3番6号 株式
会社リコー内

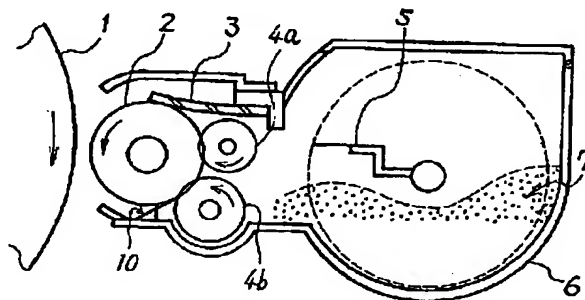
(74) 代理人 弁理士 黒田 壽

(54) 【発明の名称】 現像装置

(57) 【要約】

【課題】 現像剤担持体上の現像剤層の帯電均一化及び層厚の一定化を達成することができ、かつ現像器壁と現像剤担持体との間隙をシールするシール部材を不要とし、設ける場合であってもその構成を簡単化できる現像装置を提供する。

【解決手段】 現像ローラ2よりトナーホッパ6側の位置で現像ローラ2に接触し、かつ現像ローラ2が配設されている位置に対して上部及び下部に、トナーを現像ローラ2に供給する回転型のトナー供給ローラ4a、4bを設けるとともに、これらの供給ローラ4a、4bの間に介在するトナーを、トナーホッパ6側から現像ローラ2側に移動させるように、供給ローラ4a、4bの回転方向を、それぞれ互いに異なる方向となるよう設定する。



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【特許請求の範囲】

【請求項 1】 必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、現像器内に収容される側の周面が下方から上方に移動するように回転する現像剤担持体と、該現像剤担持体上の現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、

該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触あるいは非接触で配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設けたことを特徴とする現像装置。

【請求項 2】 上記第一現像剤供給部材と上記第二現像剤供給部材との間が、現像剤が滞留できる程度の間隔を有するように、両部材を配設したことを特徴とする請求項 1 の現像装置。

【請求項 3】 必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、現像器内に収容される側の周面が下方から上方に移動するように回転する現像剤担持体と、該現像剤担持体上の現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、該現像剤担持体より現像剤搬送方向の上流側で、該現像剤担持体に接触しながら該現像剤担持体の回転方向と同方向に回転し、現像剤を該現像剤担持体に供給する回転型の現像剤供給部材を設けるとともに、該現像剤供給部材の上方に、該現像剤担持体及び該現像剤供給部材の回転方向とは逆方向に回転する現像剤搬送部材を設けたことを特徴とする現像装置。

【請求項 4】 必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、現像器内に収容される側の周面が下方から上方に移動するように回転する現像剤担持体と、該現像剤担持体上の現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、該現像剤担持体より現像剤搬送方向の上流側で、該現像剤担持体に接触しながら該現像剤担持体の回転方向とは逆方向に回転し、現像剤を該現像剤担持体に供給する回転型の現像剤供給部材を設けるとともに、該現像剤供給部材の下方に、該現像剤担持体の回転方向と同方向に回転する現像剤搬送部材を設けたことを特徴とする現像装置。

【請求項 5】 必要に応じて補助剤を外添した一成分系現

像剤を所望の極性に帯電させて担持し、現像器内に収容される側の周面が下方から上方に移動するように回転する現像剤担持体と、該現像剤担持体上の現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、

該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触するように配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設け、

前記第一現像剤供給部材及び第二現像剤供給部材を発泡樹脂部材を用いて構成し、かつ前記第一現像剤供給部材を、前記第二現像剤供給部材の発泡密度よりも大きい発泡密度を有するように構成したことを特徴とする現像装置。

【請求項 6】 必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、現像器内に収容される側の周面が下方から上方に移動するように回転する現像剤担持体と、該現像剤担持体上の現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、

該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触するように配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設け、

前記現像剤担持体に対する前記第二現像剤供給部材の食い込み量を、前記第一現像剤供給部材の食い込み量よりも大きくするように各供給部材を配設したことを特徴とする現像装置。

【請求項 7】 必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、現像器内に収容される側の周面が下方から上方に移動するように回転する現像剤担持体と、該現像剤担持体上の現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材

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と、
該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触するように配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設け、

前記第一現像剤供給部材及び第二現像剤供給部材を発泡樹脂部材を用いて構成し、前記第二現像剤供給部材の樹脂肉厚を、前記第一現像剤供給部材の樹脂肉厚よりも厚くしたことを特徴とする現像装置。

【請求項8】必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、現像器内に収容される側の周面が下方から上方に移動するように回転する現像剤担持体と、該現像剤担持体上の現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、

該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触するように配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設け、
前記第一現像剤供給部材の支持軸を、前記第二現像剤供給部材の支持軸よりも太くしたことを特徴とする現像装置。

【請求項9】必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、現像器内に収容される側の周面が下方から上方に移動するように回転する現像剤担持体と、該現像剤担持体上の現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、

該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触するように配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設け、

前記現像剤担持体に対する前記第一現像剤供給部材の速度比を、前記現像剤担持体上の残現像剤を掻き取り、現像器内に搬送できる程度であって、かつ1以下に設定し、

前記現像剤担持体に対する前記第二現像剤供給部材の速

度比を、前記現像剤担持体上に帯電可能な十分な量の現像剤を供給できる程度であって、かつ1以下に設定したことを特徴とする現像装置。

【請求項10】請求項1、3、4、5、6、7、8、又は9の現像装置において、

上記現像剤担持体と現像器下部の現像器壁との隙間を塞ぎ、該隙間からの現像剤飛散を防止するシール部材を設けたことを特徴とする現像装置。

【請求項11】必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、潜像担持体に対向する現像領域に搬送する現像剤担持体と、該現像剤担持体上に担持されて該現像領域に搬送される現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、

該現像剤担持体に対しそれぞれ現像剤貯溜部側から接触あるいは近接し、それぞれ互いの対向領域を介して該現像剤貯蔵部側の現像剤を該現像剤担持体側に移動させるように回転する第一及び第二の現像剤供給部材を、該互いの対向領域における最接近間隔が、次の下限以上、かつ、上限以下の範囲内のものになるように設けたことを特徴とする現像装置。上記範囲の下限は、現像による現像剤消費が上記現像剤担持体の長手方向で片側に片寄った場合にも、上記領域内現像剤量の片寄りを、上記現像剤担持体に対する供給現像剤量が上記現像剤担持体長手方向で不均一にならない程度に抑えることができる、両現像剤供給部材及び現像剤担持体に挟まれた領域への上記現像剤貯溜部側からの現像剤流入量を確保できる最小の間隔である。上記範囲の上限は、上記両現像剤供給部材及び現像剤担持体に挟まれた領域内の現像剤圧力を、現像剤担持体表面に付着し、上記第1及び第2の現像剤供給部材のうち上記現像剤担持体による現像剤搬送方向下流側の現像剤供給部材と、該現像剤担持体との接触あるいは近接部を通過する現像剤量が不安定にならない程度に確保することができる、上記最接近間隔部を介しての該領域から上記貯蔵部側への現像剤の戻りに対する規制力を得ることができる最大の間隔である。

【請求項12】必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、潜像担持体に対向する現像領域に搬送する現像剤担持体と、該現像剤担持体上に担持されて該現像領域に搬送される現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、

該現像剤担持体に対しそれぞれ現像剤貯溜部側から接触あるいは近接し、それぞれ互いの対向領域を介して該現像剤貯蔵部側の現像剤を該現像剤担持体側に移動させるように回転する第一及び第二の現像剤供給部材と、

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両現像剤供給部材間に、上記現像剤担持体による現像剤搬送方向上流側の現像剤供給部材側から他方の現像剤供給部材側に向けて所望の極性に帯電した現像剤を移動させる向きの電界を形成する電位差を形成する電圧印加手段とを設けたことを特徴とする現像装置。

【請求項13】必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、潜像担持体に対向する現像領域に搬送する現像剤担持体と、該現像剤担持体上に担持されて該現像領域に搬送される現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、

該現像剤担持体に対しそれぞれ現像剤貯溜部側から接触あるいは近接し、それぞれ互いの対向領域を介して該現像剤貯溜部側の現像剤を該現像剤担持体側に移動させるように回転する第一及び第二の現像剤供給部材を設け、上記現像剤担持体による現像剤搬送方向上流側の現像剤供給部材の方が、他方の現像剤供給部材よりも、該現像剤担持体に対する接触幅あるいは近接幅が大きくなるように、両現像剤規制部材の長さを設定したことを特徴とする現像装置。

【請求項14】必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、潜像担持体に対向する現像領域に搬送する現像剤担持体と、該現像剤担持体上に担持されて該現像領域に搬送される現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、

該現像剤担持体に対しそれぞれ現像剤貯溜部側から接触あるいは近接し、それぞれ互いの対向領域を介して該現像剤貯溜部側の現像剤を該現像剤担持体側に移動させるように回転する、該現像剤担持体の幅よりも狭い第一及び第二の現像剤供給部材を設け、第一及び第二の現像剤供給部材よりも該現像剤担持体幅方向外側において、該現像剤担持体幅方向外側への該現像剤担持体上での現像剤の移動を規制する規制部材を、上記現像剤担持体による現像剤搬送方向における、第一及び第二の現像剤供給部材それぞれが該現像剤担持体に対して接触あるいは近接する部分間にわたって設けたことを特徴とする現像装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、複写機、ファクシミリ、プリンター等の画像形成装置の現像装置に係り、詳しくは、必要に応じて補助剤を外添した一成分系現像剤を、所望の極性に帯電させて潜像担持体上潜像の現像に用いる現像装置に関するものである。

【0002】

【従来の技術】潜像を像担持体上に形成し、これを現像剤によって可視化する画像形成装置において、現像装置の小型化、低コスト化、高信頼性等の点から一成分系現像剤を用いた現像装置が有利である。特にカラー化を行う場合には、磁性一成分系現像剤よりも非磁性一成分系現像剤を用いる方が、透明度が高いという点で有利である。一成分系現像剤を用いた現像装置としては、表面に一成分系現像剤を担持し現像領域を含む所定の循環経路に沿って搬送する現像剤担持体と、一成分系現像剤を貯溜する貯溜部と、該現像剤担持体に接触し該現像剤貯溜部に貯溜されている一成分系現像剤を該現像剤担持体に供給する現像剤供給手段とを有するものが知られている（例えば、特開昭60-229057号公報、特開昭61-42672号公報参照）。

【0003】そして、この種の現像装置では、上記現像剤担持体上に担持される単位面積当たりの現像剤量を多くするための提案も各種なされている。例えば、先に本出願人は、現像剤担持体として、表面が規則的または不規則的に微小面積で分布した誘電部と接地された導電部とから現像剤担持体を用い、この現像剤担持体とその表面に接触する位置で回転する現像剤供給部材との接触部において、一成分系現像剤を摩擦帯電し、かつ、前記誘電部を現像剤供給部材及び一成分系現像剤により摩擦帯電して前記現像剤担持体表面近傍に多数の微小電界を形成し、この微小電界により、現像剤供給部材から現像剤担持体に一成分系現像剤を転移させて現像剤担持体上に多層に担持させる現像装置を提案した（特開平4-127177号）。図9（a）は、この提案に係る現像装置の具体例における、現像剤担持体としての現像ローラの表面の一部を示す平面図、図9（b）は同図（a）中のX-X断面図である。この現像ローラは接地された導電部51と、誘電体材料から成る誘電部52とが、規則的に微小面積で分布した表面を有し、同図（b）に示す電気力線で表される微小電界が形成されている。このような現像装置の提案は、次のような背景に鑑みなされたものである。

【0004】例えば非磁性の一成分系現像剤（以下、トナーという）を用いた現像方式において、現像剤担持体上のトナー付着量は、像担持体上で $0.6 \sim 1.0 \text{ mg/cm}^2$ 程度のトナー付着量、転写紙上で $0.5 \sim 0.7 \text{ mg/cm}^2$ 程度のトナー付着量が、それぞれ得られるものであることが望ましい。この像担持体上及び転写紙上のトナー付着量は、現像剤担持体上のトナー付着量のみならず、現像領域における像担持体と現像剤担持体との相対速度によっても左右される。ところが、従来実用化されているこの種の現像装置によれば、現像剤担持体上のトナー層が1層と付着量が少ないために、現像剤担持体上でのトナー付着量は $0.2 \sim 0.5 \text{ mg/cm}^2$ であり、上記の像担持体上での所望のトナー付着量を得るためには、現像剤担持体のスピードを像担持体のスピードの2～4倍

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に設定する必要があった。このように現像剤担持体上でのトナー付着量不足をカバーするために現像剤担持体の回転を高く設定する場合には、画像形成スピードの高速化が困難であるばかりでなく、ベタ部を現像したときに画像の後端部の濃度が高くなる“トナー後端寄り”という現象も発生する。この現象は白黒画像では大きな問題ではないが、カラー画像ではトナーを透過して色を視覚するため後端部で濃度が濃くなり、特に重ね画像の場合は色違いになってしまうという不具合が生じてしまっていた。

【0005】このような“トナー後端寄り”という現象を発生させずに、かつ、像担持体上で所望のトナー付着量を得るためには、現像剤担持体のスピードを像担持体のスピードに近づける、つまり、等速現像に近づけるとともに、現像剤担持体上へのトナー付着量を従来に比して多くすることが必要である。具体的には、像担持体や転写紙上での十分なトナー付着量を、ほぼ等速現像で確保するためには、現像剤担持体上のトナー付着量を、現像効率の良い接触現像法で少なくとも 0.8 mg/cm^2 、現像効率の悪い非接触現像法で少なくとも 1.0 mg/cm^2 にする必要がある。このような現像剤担持体上のトナー付着量を得るためには、2層以上、すなわち多層のトナー層厚にする必要があった。しかも、現像領域に搬送される現像剤担持体上のトナー層に無帯電トナーや逆帯電トナーが含まれていると、現像転移の悪化、地肌汚れ、解像度劣化等の原因にもなるので、帯電不足になりがちな、現像剤担持体上のトナー層の上層部のトナーも含め、トナー層のトナー全てが帯電し、トナー帯電量分布も安定したトナー層を形成することが望まれていた。また、トナーの平均帯電量は $5 \sim 10 \mu\text{C/g}$ の範囲内になることが望まれていた。

【0006】そこで、現像剤担持体上に帯電量の安定した多層のトナー層を形成できる現像装置として、上記現像装置を提案したものである。この提案に係る現像装置によれば、現像剤担持体上に形成される微小電界により、現像剤供給部材から現像剤担持体に一成分系現像剤を転移させて現像剤担持体上に多層に担持させるので、現像剤担持体上に帯電量の安定した多層のトナー層を形成でき、システムの安定化、画像品質の向上が可能となった。

【0007】

【発明が解決しようとする課題】ところが、上述したような、現像剤担持体上に形成される微小電界により、現像剤供給部材から該現像剤担持体に一成分系現像剤を転移させて該現像剤担持体上に多層に担持させる一成分現像装置においては、上記現像剤供給部材4と上記現像剤担持体2とが同方向に回転している場合、例えば、図10に示すような反時計方向に回転している場合、上記現像剤貯溜部6から該現像剤担持体2側に投入された一成分系現像剤の一部が、該現像剤供給部材4と該現像剤担

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持体2とが接触する領域を通過せずに、いきなり該現像剤担持体2上へ搬送され、現像剤規制部材3によって現像剤層が形成されてしまう恐れがある。このように現像剤が搬送されてしまうと、摩擦帯電が不十分な状態で、しかも現像剤層が該現像剤担持体2上に厚めに形成されるため、現像ムラや現像剤飛散が生じる恐れがあるという不具合があった。

【0008】また、ベタ現像により現像剤が多量に消費されたときには、一回の現像剤供給動作では十分な供給量が得られず、現像剤担持体が現像剤供給領域を数回通過しなければ所望の層厚及び帯電量を得ることができなかった。

【0009】また、図11に示すように、該現像剤供給部材4が時計方向に回転し、該現像剤供給部材4と現像剤担持体2とが互いに異なる方向に回転しているような場合には、該現像剤貯溜部6から該現像剤担持体2側に投入された一成分系現像剤は、該現像剤供給部材4の下方を通過して該現像剤供給部材4と該現像剤担持体2とが接触する領域に搬送されるので、該現像剤担持体2に担持される現像剤の帯電は均一に行われる。しかし、この場合は、該現像剤担持体2下部で搬送された現像剤が該現像剤担持体2と現像器壁との間から飛散しないように堰き止めるためのシール機構10が必要になるだけでなく、このシール機構10にかかる負担が大きくなるため、該現像剤を確実に堰き止めるための機構が複雑になってしまうという不具合が生じるという問題点があった。なお、上記不具合は、上述した、現像剤担持体上に形成される微小電界により、現像剤供給部材から現像剤担持体に一成分系現像剤を転移させる現像装置に限らず、生じることがある。

【0010】本発明は、上記問題点を鑑みなされたものであり、その第一の目的とするところは、一成分系現像剤を用いる現像装置において、現像剤担持体上の現像剤層の帯電均一化及び層厚の一定化を達成することができ、かつ現像器壁と現像剤担持体との間隙をシールするシール部材を不要とし、設けるとしてもその構成を簡単化できる現像装置を提供することである。また、その第二の目的とするところは、ベタ現像により現像剤が多量に消費されても、一回の供給動作で現像剤を確実に現像剤担持体上へ供給することにより、現像剤供給不足の発生を確実に防止できる現像装置を提供することである。

(以下、余白)

0.2mm以上かつ2.0mm以下の

【0011】

【課題を解決するための手段】請求項1乃至10の現像装置は、必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、現像器内に收容される側の周面が下方から上方に移動するように回転する現像剤担持体と、該現像剤担持体上の現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材

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で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置である。

【0012】この基本構成において、上記第一の目的を達成するため、請求項1の現像装置は、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触あるいは非接触で配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設けたことを特徴とするものである。

【0013】更に、請求項2の現像装置は、請求項1の現像装置において、上記第一現像剤供給部材と上記第二現像剤供給部材との間が、現像剤が滞留できる程度の間隔を有するように、両部材を配設したことを特徴とするものである。

【0014】また、請求項3の現像装置は、上記基本構成において、該現像剤担持体より現像剤搬送方向の上流側で、該現像剤担持体に接触しながら該現像剤担持体の回転方向と同方向に回転し、現像剤を該現像剤担持体に供給する回転型の現像剤供給部材を設けるとともに、該現像剤供給部材の上方に、該現像剤担持体及び該現像剤供給部材の回転方向とは逆方向に回転する現像剤搬送部材を設けたことを特徴とするものである。

【0015】また、請求項4の現像装置は、上記基本構成において、該現像剤担持体より現像剤搬送方向の上流側で、該現像剤担持体に接触しながら該現像剤担持体の回転方向とは逆方向に回転し、現像剤を該現像剤担持体に供給する回転型の現像剤供給部材を設けるとともに、該現像剤供給部材の下方に、該現像剤担持体の回転方向と同方向に回転する現像剤搬送部材を設けたことを特徴とするものである。

【0016】上記第二の目的を達成するために、請求項5の現像装置は、上記基本構成において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触するように配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設け、前記第一現像剤供給部材及び第二現像剤供給部材を発泡樹脂部材を用いて構成し、かつ前記第一現像剤供給部材を、前記第二現像剤供給部材の発泡密度よりも大きい発泡密度を有するように構成したことを特徴とするものである。

【0017】また、請求項6の現像装置は、上記基本構成において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向す

る面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触するように配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設け、前記現像剤担持体に対する前記第二現像剤供給部材の食い込み量を、前記第一現像剤供給部材の食い込み量よりも大きくするように各供給部材を配設したことを特徴とするものである。

【0018】また、請求項7の現像装置は、上記基本構成において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触するように配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設け、前記第一現像剤供給部材及び第二現像剤供給部材を発泡樹脂部材を用いて構成し、前記第二現像剤供給部材の樹脂肉厚を、前記第一現像剤供給部材の樹脂肉厚よりも厚くしたことを特徴とするものである。

【0019】また、請求項8の現像装置は、上記基本構成において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触するように配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設け、前記第一現像剤供給部材の支持軸を、前記第二現像剤供給部材の支持軸よりも太くしたことを特徴とするものである。

【0020】また、請求項9の現像装置は、上記基本構成において、該現像剤担持体よりも現像剤貯溜部側で該現像剤担持体と接触し、現像器下部の現像器壁と対向する面が現像剤貯蔵部側に移動するように回転する第一現像剤供給部材と、該第一現像剤供給部材よりも現像剤搬送方向下流側であって、かつ該現像剤規制部材よりも上流側に、該現像剤担持体と接触するように配置され、該第一現像剤供給部材とは異なる方向に回転する第二現像剤供給部材とを設け、前記現像剤担持体に対する前記第一現像剤供給部材の速度比を、前記現像剤担持体上の残現像剤を掻き取り、現像器内に搬送できる程度であって、かつ1以下に設定し、前記現像剤担持体に対する前記第二現像剤供給部材の速度比を、前記現像剤担持体上に帯電可能な十分な量の現像剤を供給できる程度であって、かつ1以下に設定したことを特徴とするものである。

【0021】更に、請求項10の現像装置は、請求項

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1、3、4、5、6、7、8、又は9の現像装置において、上記現像剤担持体と現像器下部の現像器壁との隙間を塞ぎ、該隙間からの現像剤飛散を防止するシール部材を設けたことを特徴とするものである。

【0022】上記第一の目的を達成するため、請求項11乃至14の現像装置は、必要に応じて補助剤を外添した一成分系現像剤を所望の極性に帯電させて担持し、潜像担持体に対向する現像領域に搬送する現像剤担持体と、該現像剤担持体上に担持されて該現像領域に搬送される現像剤を所定の層厚に規制する現像剤規制部材とを有し、該現像剤規制部材で規制された該現像剤担持体上の現像剤を用いて、潜像担持体上の潜像を現像する現像装置において、該現像剤担持体に対しそれぞれ現像剤貯溜部側から接触あるいは近接し、それぞれ互いの対向領域を介して該現像剤貯蔵部側の現像剤を該現像剤担持体側に移動させるように回転する第一及び第二の現像剤供給部材を設けた基本構成を有する。

【0023】特に、請求項11の現像装置は、上記基本構成において、上記第一及び第二の現像剤供給部材を、該互いの対向領域における最接近間隔が、次の下限以上、かつ、上限以下の範囲内のものになるように設けたことを特徴とするものである。すなわち、上記範囲の下限は、現像による現像剤消費が上記現像剤担持体の長手方向で片側に片寄った場合にも、上記領域内現像剤量の片寄りを、上記現像剤担持体に対する供給現像剤量が上記現像剤担持体長手方向で不均一にならない程度に抑えることができる、両現像剤供給部材及び現像剤担持体に挟まれた領域への上記現像剤貯溜部側からの現像剤流入量を確保できる最小の間隔である。また、上記範囲の上限は、上記両現像剤供給部材及び現像剤担持体に挟まれた領域内の現像剤圧力を、現像剤担持体表面に付着し、上記第1及び第2の現像剤供給部材のうち上記現像剤担持体による現像剤搬送方向下流側の現像剤供給部材と、該現像剤担持体との接触あるいは近接部を通過する現像剤量が不安定にならない程度に確保することができる、上記最接近間隔部を介しての該領域から上記貯蔵部側への現像剤の戻りに対する規制力を得ることができる最大の間隔である。

【0024】また、請求項12の現像装置は、上記基本構成において、上記第1及び第2の現像剤供給部材間に、上記現像剤担持体による現像剤搬送方向上流側の現像剤供給部材側から他方の現像剤供給部材側に向けて所望の極性に帯電した現像剤を移動させる向きの電界を形成する電位差を形成する電圧印加手段とを設けたことを特徴とするものである。

【0025】また、請求項13の現像装置は、上記基本構成において、上記現像剤担持体による現像剤搬送方向上流側の現像剤供給部材の方が、他方の現像剤供給部材よりも、該現像剤担持体に対する接触幅あるいは近接幅が大きくなるように、両現像剤規制部材の長さを設定し

たことを特徴とするものである。

【0026】また、請求項14の現像装置は、上記基本構成において、上記第一及び第二の現像剤供給部材として、上記現像剤担持体の幅よりも狭い幅のものをを用い、該第一及び第二の現像剤供給部材よりも該現像剤担持体幅方向外側において、該現像剤担持体幅方向外側への該現像剤担持体上での現像剤の移動を規制する規制部材を、上記現像剤担持体による現像剤搬送方向における、第一及び第二の現像剤供給部材それぞれが該現像剤担持体に対して接触あるいは近接する部分間にわたって設けたことを特徴とするものである。

【0027】請求項1の現像装置においては、第一現像剤供給部材と、第二現像剤供給部材との間に、現像剤貯蔵部内に收容されている現像剤搬送手段などによって現像剤が搬送される。搬送された現像剤は、第一現像剤供給部材と第二現像剤供給部材との間で現像剤担持体側に移動する。そして、第二現像剤供給部材は、第一現像剤供給部材と現像剤担持体との接触領域で現像剤担持体上に担持された現像剤が、現像剤規制部材によって薄層化される前に、現像剤をある程度規制する。また該第二現像剤供給部材は、該第二現像剤供給部材と現像剤担持体との対向部を通過し、現像剤担持体上に担持されずに該第二現像剤供給部材の上方に移動した現像剤を、現像剤貯蔵部側へ戻すように移動させ、現像剤規制部材によって薄層化されないようにする。一方、該第一現像剤供給部材は、該第二現像剤供給部材との間に搬送された未帯電の現像剤を、現像剤担持体上に供給するとともに、現像剤担持体と該第一現像剤供給部材との接触領域で、現像終了後に現像剤担持体上に残留した現像剤を掻き落す。更に、該第一現像剤供給部材の下方に掻き落した現像剤を、現像剤貯蔵部側へ戻すように移動させる。

【0028】請求項2の現像装置においては、上記第二現像剤供給部材と第一現像剤供給部材との間に、現像剤貯溜部側から搬送された現像剤によって現像剤溜りが形成される。更に、現像剤溜りには、現像剤担持体上に担持されずに第二現像剤供給部材の上方に移動し、該第二現像剤供給部材により現像剤貯蔵部側へ戻された現像剤や、該第一現像剤供給部材により現像後の現像剤担持体から掻き落され、現像剤貯蔵部側へ戻された現像剤も、供給される。

【0029】請求項3の現像装置においては、現像剤担持体に接触する現像剤供給部材が、現像器内に收容される側の周面が下方から上方に移動するように回転する現像剤担持体の回転方向と同方向に回転し、現像剤を現像剤担持体に供給する。一方、現像剤供給部材の上方に設けられた現像剤搬送部材が、現像剤担持体及び現像剤供給部材の回転方向とは逆方向に回転することにより、現像剤貯溜部内に有する現像剤搬送手段等によって該供給部材側に搬送された現像剤を、現像剤供給部材と現像剤搬送部材との間を搬送し、現像剤担持体側に移動する。

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また、現像剤搬送部材と現像剤担持体との間を通過し、現像剤担持体上に担持されずに現像剤搬送部材の上方に移動した現像剤を、現像剤搬送部材の上方で滞留させることなく円滑に現像剤貯溜部側へ戻すように搬送する。これにより、現像剤担持体上に担持されなかった現像剤が、現像剤担持体表面と該表面に当接している現像剤規制部材との間に過剰に詰め込まれることを防止する。そして、現像剤搬送部材と現像剤供給部材との間に介在する現像剤が、これら各部材の回転によって現像剤担持体上に確実に搬送されるので、現像剤担持体上に供給され 10
る現像剤の量が不足することがない。

【0030】請求項4の現像装置においては、現像剤担持体に接触する現像剤供給部材が、現像器内に収容される側の周面が下方から上方に移動するように回転する現像剤担持体の回転方向と逆方向に回転し、現像剤を現像剤担持体に供給する。一方、現像剤供給部材の下方に設けられ、現像剤担持体の回転方向と同方向に回転する現像剤搬送部材が、現像剤貯蔵部側に現像剤を、現像剤供給部材との間を搬送し、現像剤担持体側に移動する。また現像剤担持体と現像剤搬送部材との間を通過して現像剤 20
搬送部材の下方に搬送された現像剤を、現像剤貯溜部側へ戻すように搬送する。これにより、現像剤搬送部材の下方に掻き落された現像剤が、現像剤搬送部材の下方にそのまま滞留するのを防止する。そして、現像剤搬送部材と現像剤供給部材との間に介在する現像剤が、これら各部材の回転によって現像剤担持体上に確実に搬送されるので、現像剤担持体上に供給される現像剤の量が不足することがない。

【0031】請求項5の現像装置においては、第二現像剤供給部材の発泡密度を第一現像剤供給部材よりも大きくすることにより、第一現像剤供給部材については現像剤掻き取り機能を向上させる。また、第二現像剤供給部材については第一現像剤供給部材、第二現像剤供給部材及び現像剤担持体で囲まれる領域に滞留させた現像剤を、第二現像剤供給部材と現像剤担持体との接触部を介して通過させるようにし、現像装置内の現像剤の循環を促進させ、かつ摩擦帯電効率を向上させる。 30

【0032】請求項6の現像装置においては、現像剤担持体に対する第二現像剤供給部材の食い込み量を第一現像剤供給部材の食い込み量よりも大きくすることにより、第一現像剤供給部材については駆動トルクを低減させる。また、第二現像剤供給部材については現像剤担持体との接触部を通過する現像剤を効率良く摩擦帯電させるとともに、現像剤規制部材通過前の現像剤担持体上の供給量を最適化する。 40

【0033】請求項7の現像装置においては、第二現像剤供給部材の肉厚が第一現像剤供給部材の肉厚よりも厚くすることにより、第一現像剤供給部材については肉厚部分の弾性力を弱め、現像後の現像剤担持体上の現像剤掻き取り効率を更に向上させる。また、第二現像剤供給 50

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部材については上記現像剤担持体上に弾性的に密着させて現像剤帯電・供給効率を更に向上させる。

【0034】請求項8の現像装置においては、第一現像剤供給部材の支持軸を第二現像剤供給部材の支持軸よりも太くすることにより、現像後に現像剤担持体上に残った現像剤を掻き取る第一現像剤供給部材の支持軸のフレヤたわみを軽減する。

【0035】請求項9の現像装置においては、現像剤担持体に対する第一現像剤供給部材の速度比が、少なくとも現像剤担持体上の現像残現像剤を掻き取り、現像器内に搬送できる程度であるため、現像剤担持体上の現像残現像剤の掻き取り効率及び掻き取った現像剤を現像器内に搬送する搬送効率を維持することができる。また、1を上限とすることにより、1より大きい速度比に設定した場合とは異なり、現像剤担持体と第一現像剤供給部材との接触部を通過後の現像剤担持体上に現像剤が過剰に供給されることを防止できる。また、現像剤担持体に対する第二現像剤供給部材の速度比が、少なくとも現像剤担持体上に帯電可能な十分な量の現像剤を供給できる程度であるため、現像剤担持体上への現像剤供給効率及び帯電効率を維持することができる。また、1を上限とすることにより、1より大きい速度比に設定した場合とは異なり、現像剤担持体と第一現像剤供給部材との接触部を通過後の現像剤担持体上に現像剤が過剰に供給されることを防止できる。

【0036】請求項10の現像装置においては、上記現像剤担持体と現像器下部の現像器壁との隙間をシールするシール部材で塞ぐことにより、該隙間からの現像剤飛散を防止する。また、上記第一現像剤供給部材の下方に掻き落された現像剤を、第一現像剤供給部材が現像剤貯蔵部側へ戻すように移動させ、前記シール部材に対して現像剤による過度の圧力がかかることのないようにする。

【0037】請求項11乃至14の現像装置においては、現像剤貯蔵部側の現像剤を、第一及び第二の現像剤供給部材の回転により両現像剤供給部材間の対向領域を介して現像剤担持体側に移動し、現像剤担持体の表面に供給する。このようにして供給された現像剤のうち、現像剤担持体に付着し、上記第1及び第2の現像剤供給部材のうち上記現像剤担持体による現像剤搬送方向下流側の現像剤供給部材と、該現像剤担持体との接触あるいは近接部を通過した現像剤が、現像剤規制部材により所定の層厚に規制され、更に現像剤担持体により潜像担持体と対向する現像領域に搬送され、該潜像担持体上潜像の現像に供される。

【0038】ここで、上記両現像剤供給部材及び現像剤担持体によって囲まれた領域には、該両現像剤供給部材により、現像剤貯溜部側から現像剤が供給され、所定の現像剤圧が生じている。この現像剤圧により、両現像剤供給部材や現像剤担持体との間の現像剤の摩擦帯電が良

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好に行なえる。

【0039】また、上記第一及び第二の現像剤供給部材は、それぞれ互いの対向領域を介して該現像剤貯蔵部側の現像剤を現像剤担持体側に移動させるように回転することから、良子現像剤供給部材それぞれの現像剤担持体との接触あるいは近接部を通過した表面部分は、現像剤担持体から離れて現像剤貯蔵部側に移動する。この移動により、該接触あるいは近接部を通過した直後の表面部分近傍に存在する現像剤担持体表面に付着していない現像剤を、現像剤貯蔵部側に移動させることができる。よって、上記現像剤規制部材で現像領域への搬送が規制され、上記第1及び第2の現像剤供給部材のうち上記現像剤担持体による現像剤搬送方向下流側の現像剤供給部材の近傍に留まる現像剤は、該現像剤搬送方向下流側の現像剤供給部材により現像剤貯蔵部側に戻される。また現像領域を通過して現像器内にもどってきた現像担持体表面部分から、例えば他方の現像剤供給部材により掻き落とされた現像剤は、該他方の現像剤供給部材により現像剤貯蔵部側に戻される。

【0040】そして、請求項11の現像装置においては、上記第一現像剤供給部材と第二現像剤供給部材との対向領域における最接近間隔の設定が、両現像剤供給部材及び現像剤担持体に挟まれた領域への上記現像剤貯溜部側からの現像剤流入量を十分に確保できるものであるため、現像による現像剤消費が上記現像剤担持体の長手方向で片側に片寄った場合にも、上記領域内の現像剤量の片寄りを、上記現像剤担持体に対する供給現像剤量が上記現像剤担持体長手方向で不均一にならない程度に抑えることができる。

【0041】更に上記最接近間隔の設定は、該最接近間隔部を介しての上記領域から現像剤貯蔵部側への現像剤の戻りに対する十分な規制力を得ることができるものであるため、上記領域内の十分な現像剤圧力を確保できる。よって、現像剤担持体表面に付着し、上記第1及び第2の現像剤供給部材のうち上記現像剤担持体による現像剤搬送方向下流側の現像剤供給部材と、該現像剤担持体との接触あるいは近接部を通過する現像剤量を安定させることができる。

【0042】また、請求項12の現像装置においては、電圧印加手段により上記第1及び第2の現像剤供給部材間に電位差を形成して、上記現像剤担持体による現像剤搬送方向上流側の現像剤供給部材側から他方の現像剤供給部材側に向けて所望の極性に帯電した現像剤を移動させる向きの電界を形成する。この電界により第一及び第二の現像剤供給部材にはさまれた領域において所望の極性に帯電した現像剤のみ他方の現像剤担持体側へ送り込み、未帯電または逆極性に帯電した現像剤は上記現像剤搬送方向上流側の現像剤供給部材側へ送る。上記他方の現像剤担持体側へ送り込まれた現像剤は、そのまま該現像剤担持体によって現像剤担持体との接触あるいは近接

部に送られる確率が高く、このように送られた現像剤のほとんどは、この接触あるいは近接部を通過するのに伴って摩擦帯電された後に、現像剤担持体により現像剤規制部材側に搬送される。一方、上記現像剤搬送方向上流側の現像剤供給部材側へ送られた現像剤は、該現像剤供給部材により現像剤担持体との接触あるいは近接部に送られ、ここで摩擦帯電された後、更に現像剤担持体に対する上記他方の現像剤担持体の接触あるいは近接部を通過しなければ、現像剤規制部材側に搬送されない。これにより、第一及び第二の現像剤供給部材にはさまれた領域において所望の極性に帯電した現像剤を集中的に速やかに現像剤規制部材側に搬送する一方、該領域において未帯電または逆極性に帯電した現像剤は、現像剤供給部材や現像剤担持体と接触して摩擦帯電する機会を増加させることにより所望の極性に帯電した後に、現像剤規制部材側に搬送するようにする。

【0043】また、請求項13の現像装置においては、上記現像剤担持体による現像剤搬送方向上流側の現像剤供給部材の方が、他方の現像剤供給部材よりも、該現像剤担持体に対する接触幅あるいは近接幅が大きい。ここで、第一及び第二の現像剤供給部材の間に挟まれた領域は現像剤の圧力が高く現像剤担持体幅方向端部においては現像剤が外側に吹きだそうとする。請求項13の現像装置と異なり、第一及び第二の現像剤供給部材の幅方向の長さが互いに等しいか、あるいは、現像剤担持体による現像剤搬送方向上流側の現像剤供給部材の方が長いと、端部より吹き出した現像剤のなかに現像剤規制部材の端部へ向かうものが生じる。現像剤規制部材と現像剤担持体が当接している端部に現像剤がふりかかる状態が継続されると、現像剤が現像剤規制部材に沿って幅方向外側に進み、現像装置外へ漏れだして装置内を汚染してしまう。請求項13の現像装置においては、現像剤担持体による現像剤の搬送方向下流側に位置する現像剤供給部材の方が現像剤担持体に対する接触あるいは近接部の幅が長いと、現像剤の吹き出す方向が、上記現像剤の搬送方向上流側に制限される。なお、上記現像剤搬送方向上流側に吹き出した現像剤は、該上流側にいちする現像剤貯蔵部に戻る。

【0044】また、請求項14の現像装置においては、第一及び第二の現像剤供給部材の間に挟まれた領域は現像剤の圧力が高く、該領域の端部において現像剤が幅方向外側に漏れ出ようとする。この漏れ出ようとする現像剤の移動を、第一及び第二の現像剤供給部材よりも現像剤担持体幅方向外側において、規制部材により規制する。

(以下、余白)

【0045】

【発明の実施の形態】以下、本発明を画像形成装置である電子写真複写機（以下、複写機という）に適用した一実施形態について説明する。

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〔実施形態1〕図2は本実施形態に係る複写機の概略図、図1は該複写機に用いられる非磁性一成分現像装置の略断面図を示す。図2において、この複写機は、帯電装置21により潜像担持体としての感光体ドラム1を帯電させた後、露光装置22により静電潜像を書き込む。その後現像装置23によって現像が行われ、感光体ドラム1上にトナー像を形成する。この後トナー像は転写・搬送部材24にて転写材としての転写紙上に転写され、転写紙上のトナー像は定着装置25の熱または圧力により転写紙に定着される。トナー像が定着された転写紙は、排紙トレイ26上に排出される。そして、感光体ドラム1上の転写残りのトナーはクリーニング装置27で掻き落されて再び画像形成に用いられる。

【0046】図1において、この現像装置23の内部には、トナー貯蔵部としてのトナーホッパー6が形成されている。図中矢印方向に約220mm/secの回転速度で回転する現像剤担持体としての現像ローラ2は、前述の図9に示す現像ローラと同様に、接地された導電部51と、誘電体材料から成る誘電部52とが、規則的に微小面積で分布した表面を有し、該誘電部52にはトナーと逆極性の電荷が蓄積された導電部との間にマイクロフィールドと呼ばれる微小電界が形成されている。そして、この現像ローラ2に対し、ホッパー6側で、かつ現像ローラ2が軸支されている位置よりも重力方向下部には、現像ローラ2と平行で、かつ接触するように第一現像剤供給部材としての発泡ポリウレタンゴムからなる下供給ローラ4bが配設されている。この下供給ローラ4bは、現像ローラ2との接触領域において、約1mm食い込んだ状態で配設されており、互いに接触する面が、現像ローラ2の回転速度の約0.8倍速で逆方向に移動するようにになっている。更に、現像ローラ2に対し、ホッパー6側で、かつ現像ローラ2が軸支されている位置よりも重力方向上部にも、現像ローラ2と平行で、かつ接触するように第二現像剤供給部材としての発泡ポリウレタンゴムからなる上供給ローラ4aが配設されている。この上供給ローラ4aは現像ローラ2との接触領域において、約0.8mm食い込んだ状態で配設されており、互いに接触する面が、現像ローラ2の回転速度の約1.2倍速で同方向に移動するようにになっている。また、現像ローラ2の回転に対してトレーリング方向から、現像剤規制部材として、弾性を有する薄層化ブレード3が面接触で現像ローラ2に当接している。

【0047】上記ホッパー6内のトナー7はアジテータ5により現像ローラ2側へ送られ、図3中白抜きの矢印で示すように移動し、上供給ローラ4aと下供給ローラ4bとの間から取り込まれる。上供給ローラ4bは、現像ローラ2と接触して回転することで、現像ローラ2の誘電部52及びトナー7の摩擦帯電を行い、帯電したトナー7は、現像ローラ2上の微小閉電界により現像ローラ2上に多層に担持される。そして、現像ロ

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ーラ2の回転に対して薄層化ブレード3の自由端が現像ローラ2に当接し、適正なトナー層厚にならされて現像域へ搬送される。そして、上記露光装置22によって潜像が書き込まれた感光体ドラム1に対してトナー7を転移させることで現像が行われる。一方、下供給ローラ4bは、現像を終了した後の現像ローラ2上のトナー7を掻き取って再びトナー7を摩擦帯電させ、現像ローラ2上に供給する。なお、感光体ドラム1の回転速度は、200mm/secであり、図中矢印方向に回転している。

【0048】本実施形態においては、上記現像装置23では、ホッパー6からアジテータ5により上下供給ローラ4b、4aの間に送られたトナー7は、この間で常にトナー溜りをつくる。このため、ベタ画像を連続して形成しても、常にこのトナー溜りから現像ローラ2上にトナー7が供給されるので、トナー供給不足による画像濃度の低下が生じることはない。また、上供給ローラ4aの回転によって薄層化ブレード3の下部に入り込もうとするトナー7がホッパー6側に戻されるので、薄層化ブレード3の下部にはトナー7が溜らなくなり、薄層化ブレード3を強い当接圧で現像ローラ2側に押しつける必要がなくなり、簡易な機構の薄層化ブレード3を用いて常にトナー層厚を一定に保つことができる。更に、下供給ローラ4bの下方のトナー7も、下供給ローラ4bの回転によりホッパー6側に戻るよう移動するため、現像装置23からのトナー飛散を防止するためにシール部材10を現像ローラ2下部に設ける必要がなくなる。なお、図1の例では、確実にトナー飛散を防止するのにシール部材10を設けているが、現像ローラ2に密着させる必要がなくなるので、その構成を簡単化することができる。

【0049】具体的な現像部品特性及び現像条件は次の通りである。

(1) 薄層化ブレード3

- ・材質 ウレタンゴム
- ・厚み 2mm
- ・自由端までのブレード長さ 11mm
- ・ローラに対するブレード食い込み量 0.6mm
- ・ブレード当接部から自由端までの突き出し量 0.5mm

(2) 現像ローラ2 (作成方法) 図4に概略図を示す。

- ・ローレットタイプで、ローラ径は20mmで、アルミ芯金に0.3mmピッチ、深さ0.1mm、溝巾0.2mmで45度の角度でアヤメローレット加工を行う。
- ・誘電層コートはエポキシ変性シリコーン樹脂(東レSR2115)をコーティングし、50℃で約90分乾燥する。
- ・ローラ表面を切削しアルミ面51と誘電面52を3:7の割合で露出させる。

(3) 供給ローラ4

- ・材料: カーボン練り込み発泡ポリウレタンスポンジロ

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ローラ

上供給ローラ：径16mm 食い込み 1mm

下供給ローラ：径14mm 食い込み 0.8mm

(4) 現像ギャップ

・150 μ m (感光体はドラムタイプを使用)

現像バイアス

・直流-750V

(5) 感光体ドラム1

・感光体種類：OPC

・表面電位：地肌部-850V、書き込み部(画像部) 10
-100V

(6) トナー7

・非磁性スチレンアクリル系+ポリエステル系樹脂使用
のマイナス帯電トナー体積平均粒径：10 μ m

・外添剤：疎水性シリカ微粉末 0.7wt%添加

【0050】ここで、図1に示す装置では、上供給ローラ4aと下供給ローラ4bとをそれぞれ現像ローラ2に接触させて配設し、上供給ローラ4a、下供給ローラ4b及び現像ローラ2で囲まれる領域にトナー溜りがつづられている。しかしながら、このトナー溜りには次々にトナー7が送りこまれてくるため、ある程度トナー搬送方向下流側に移動させ、現像器内でトナー7を循環させることが必要である。そして、このためには、上供給ローラ4aと現像ローラ2との接触部を介してトナー7が移動ししやすいようにすることが望ましい。そこで、上供給ローラ4aに用いる発泡部材はできるだけ柔らかくし、下供給ローラ4bに用いる発泡部材は、現像ローラ2上のトナー7を掻き落とす必要があるためできるだけ硬くしている。具体的には、図1のような装置の上供給ローラ4a、下供給ローラ4bに用いる発泡部材としては、例えば、上供給ローラ4aには35~65kg/cm³程度の密度のもの、下供給ローラ4bには10~30kg/cm³程度の密度のものが好適である。

【0051】このよう発泡密度の異なる供給ローラ4a、4bを用いることにより、現像によりトナー7が消費された後に、現像ローラ2上に残留したトナー7を下供給ローラ4bで掻き取ることによりある程度現像の履歴を消すことができるとともに、上記トナー溜りのトナー7が上供給ローラ4aと現像ローラ2との接触部を介して移動することにより、上供給ローラ4aで所望のトナー量を一回のトナー供給動作で確実に現像ローラ2上に供給することができるので、現像の履歴を確実に消すことができる。よって、上下供給ローラ4b、4aのそれぞれの機能を十分発揮させることができる。また、現像器内のトナー7が上記薄層化ブレード3に過剰な負荷がかからないように循環させるため、薄層化ブレード3の構成を簡単化することができる。また、シール部材10を設けている装置においても、シール部材10に過剰な負荷がかからないように循環させるため、シール部材10の構造を簡単化することができる。

【0052】図5は図1の変形例を示す概略断面図である。基本的構成は、図1と同様であり、上下供給ローラ4b、4aを互いに異なる条件に設定した点が異なる。以下、この点について説明する。

【0053】図6(a)、(b)は、図5の現像装置23において、現像ローラ2に対する上供給ローラ4aの食い込み量が下供給ローラ4bの食い込み量より大きくなるように両ローラ4a、4bを配設したときの、現像ローラ2と下供給ローラ4bとの接触部、現像ローラ2と上供給ローラ4aとの接触部をそれぞれ示している。ここで、図6(a)に示す下供給ローラ4bは、現像後に現像ローラ2上に残ったトナー7を掻きとるためにある程度現像ローラ2側に食い込ませることが望ましいが、現像ローラ2への食い込み量を大きくし過ぎると駆動トルク負荷が増大してしまうという問題が生じるため、トナー7を十分掻き取れる程度の食い込み量に設定することが望ましく、本実施形態のように供給ローラに発泡ポリウレタンを用いた場合、0.4~0.75mmの範囲になるように、下供給ローラ4bの位置を決めることが望ましい。一方、図6(b)に示す上供給ローラ4aは、現像ローラ2との接触面が互いに同方向に移動することにより、このニップ部をトナー7が通過するときに摩擦帯電及びブレード通過前のトナー付着量を最適化させる必要があることから、下供給ローラ4bの食い込み量より大きくすることが望ましく、本実施形態では、0.8~1.5mmの範囲になるように、上供給ローラ4aの位置を決めることが望ましい。これにより、上下供給ローラ4b、4aのそれぞれの機能を十分発揮させることができる。また、上供給ローラ4a1本の場合の現像装置23の駆動トルクを測定したところ、1.0~1.2kgf/cmであったのに対し、下供給ローラ4bを追加した本実施形態においては1.5kgf/cm程度であり、駆動トルクの増加を低く抑えることができた。また、上下供給ローラ4b、4aの現像ローラ2への当接による振動等の発生を抑えることができ、スムーズな駆動が可能であることが確認された。

【0054】また、上記上下供給ローラ4b、4aの肉厚を異なる肉厚に設定することによっても上下供給ローラ4b、4aのそれぞれの機能を十分発揮させることができる。すなわち、図6(a)に示した下供給ローラ4bの場合、発泡部材の弾性体としての性質はあまり要求されないのでその肉厚も厚くする必要がなく、本実施形態の装置では、2.0~3.5mmの肉厚にすることが望ましい。一方、図6(b)に示した上供給ローラ4aの場合、現像ローラ2との接触部を介してトナー7を通過させる際に、所望の摩擦帯電及びトナー層厚にするには、できるだけ現像ローラ2と密着させるようにすることが必要であり、ある程度の弾性力が要求されるため、本実施形態の装置では、4~6mmの肉厚にすることが望ましい。

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【0055】また、上記下供給ローラ4bは、現像ローラ2との接触部において、その接触面が互いに異なる方向に移動し、かつ大きな線速度差で現像ローラ2上のトナー7を掻き落とすため、下供給ローラ4bの軸41bのフレやたわみなどが生じることによってニップ部の接触が不安定になる恐れがある。一方、上供給ローラ4aは、現像ローラ2との接触部において、その接触面が互いに同じ方向に移動するため下供給ローラ4bに比べて駆動負荷が軽く、上供給ローラ4bの軸41aにはフレやたわみなどが生じにくい。このため、本実施形態では下供給ローラ4bの軸41bの軸径を7mm以上にするるとともに、上供給ローラ4bの軸41aの軸径を6mm以下にすることができる。

【0056】ここで、現像ローラ2に対する上下供給ローラ4b、4aの線速を現像ローラ2よりも速くなるように設定してしまうと、上下供給ローラ4b、4a及び現像ローラ2で囲まれたトナー溜りに搬送されるトナー量が増大し、上供給ローラ4bと現像ローラ2とのニップ部を通過するトナー量が多くなるため、現像ローラ2へ過剰にトナー7が供給されてしまうことになる。そして、現像ローラ2へ過剰にトナー7が供給されると、帯電不足のトナー7によるトナー飛散や現像ムラにつながる恐れがある。逆に、現像ローラ2に対する上下供給ローラ4b、4aの線速を現像ローラ2よりも遅くしすぎると、上供給ローラ4bにおいては十分なトナー供給ができなくなり、下供給ローラ4aにおいては現像ローラ2から掻き落としたトナー7がトナーホップ6側に戻されにくくなり、上記シール部材10に過剰な負荷をかけてしまうことになる。そこで、現像ローラ2に対する上下供給ローラ4b、4aの線速比は、上限を現像ローラ2へ過剰にトナー7が付着しない程度、望ましくは等倍以下にするとともに、その下限は、上供給ローラ4bについては現像ローラ2に十分なトナー供給ができる程度、下供給ローラ4aについては現像ローラ2から掻き落としたトナー7をトナーホップ6側に戻し、上記シール部材10に過剰な負荷がかからない程度に設定することが望ましい。このように、現像ローラ2に対する上下供給ローラ4b、4aのそれぞれの線速比が互いに異なるように各供給ローラの線速比を設定することによっても、上下供給ローラ4b、4aのそれぞれの機能を十分発揮させることができる。

【0057】変形例に係る具体的な供給ローラの条件は次の通りである。なお、他の条件は図1の現像装置と同様であるので省略する。

上供給ローラ4a

・材料：カーボン練り込み発泡ポリウレタンスポンジローラ

・発泡密度 25 kg/cm³

・ローラ径：16mm、軸径：6mm スポンジ肉厚：5mm

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・現像ローラ2に対する食い込み量：1mm

・現像ローラ2に対する線速比：0.8倍（現像ローラ2の回転とは同方向）下供給ローラ4b

・材料：カーボン練り込み発泡ポリウレタンスポンジローラ

・発泡密度 40 kg/cm³

・ローラ径：13mm、軸径：8mm スポンジ肉厚：2.5mm

・現像ローラ2に対する食い込み量：0.5mm

・現像ローラ2に対する線速比：0.5倍（現像ローラ2の回転とは逆方向）

【0058】〔実施形態2〕次に、図7を用いて、他の実施形態を説明する。この実施形態では、実施形態1と同様の現像装置及び現像部品を用いるが、発泡ポリウレタンで構成されている上側の供給ローラ4aの代わりに、この軸部分に4枚羽で構成されるアジテータ8を取り付けている。これによれば、アジテータ8の回転によって薄層化ブレード3の下部に入り込もうとするトナー7がホッパー6側に戻されるので、薄層化ブレード3の下部にはトナー7が溜らなくなり、薄層化ブレード3を強い当接圧で現像ローラ2側に押しつける必要がなくなり、簡易な機構の薄層化ブレード3を用いて常にトナー層厚を一定に保つことができる。また、常に下部供給ローラ4bとアジテータ8との間にはトナー溜りが形成されるため、ベタ画像を連続形成してもトナー供給量が不足することなく、一定の濃度が得られる。また、薄層化ブレード3の下部と現像ローラ2下部のシール部材10にはトナー7が溜りにくくなるので、簡単な構造のシール部材10を用いて安定した画像を形成することができる。なお、アジテータ8の代わりにアジテータ8の軸部分にポリエステル繊維で構成されるブラシローラを取り付けて構成しても同様の効果を得ることができる。

【0059】〔実施形態3〕次に、図8を用いて、更に他の実施形態を説明する。この実施形態では、実施形態1と同様の現像装置及び現像部品を用いるが、発泡ポリウレタンで構成される下供給ローラ4bの代わりに、この軸部分に4枚羽で構成されるアジテータ8を取り付けている。これによれば、常に上供給ローラ4aとアジテータ8との間にトナー溜りが形成されるため、ベタ画像を連続形成しても一定の濃度が得られる。また、薄層化ブレード3の下部と現像ローラ2下部のシール部材10にはトナー7が溜らなくなるので、簡単な構造のシール部材10を用いて安定した画像を形成することができる。なお、上記実施形態2と同様アジテータ8の代わりに、アジテータ8の軸部分にポリエステル繊維で構成されるブラシローラを取り付けて構成しても同様の効果を得ることができる。

【0060】〔実施形態4〕次に、図9及び図10を用いて、更に他の実施形態を説明する。この実施形態では、基本的には実施形態1と同様の構成を備えている。

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図 9 (a) に示すように、現像ローラ 2 に接触して回転する上下供給ローラ 4 a、4 b は、両ローラ間を介してホッパー 6 側のトナーを現像ローラ 2 表面側に供給するように回転している。図 9 (b) 中 k 白抜き矢印 A は、両ローラ間へのトナーホッパー側からのトナー移動を示している。また、同図中には、両ローラ近傍でのトナー移動も、白抜きの矢印で示している。トナー層形成工程の上流に位置する下供給ローラ 4 b の機能としては、ホッパー内の未帯電トナーを現像ローラ 2 上へ搬送し、接触部で現像ローラ 2 上のトナーをかきおとし、更に現像ローラ 2 下方のトナーをホッパー側へ送り戻すものである。またトナー層形成工程の下流に位置する上供給ローラ 4 a の機能としては上下の供給ローラに挟まれた領域のトナーを現像ローラ 2 との接触部を通して摩擦帯電と適量の付着量への規制を行い、かつ薄層化ブレード 3 下方に入り込んだ未帯電のトナーを再びホッパー内へ送り戻すものである。

【 0 0 6 1 】このような機能を良好に達成するためには、図 1 0 に示す 2 本の供給ローラ 4 a、4 b の最短間隙 t を 0. 2 ~ 2 mm の範囲にするのがよい。これは次の理由による。すなわち、上記 2 本の供給ローラ間の最短間隙が 0. 2 mm 以下であると、該上下供給ローラ 4 a、4 b と現像ローラ 2 に挟まれた領域 (図 1 0 斜線部) へのホッパー内トナーの流入量が少なく規制される。このためトナー消費が現像ローラ 2 の長手方向で片側に片寄った場合には該斜線部空間内トナー量の片寄りが生じ易く、トナー供給量が現像ローラ 2 長手方向に渡って不均一になり易い。また上記 2 本の供給ローラ 4 a、4 b の最短間隙が 2 mm 以上になると、一旦上記斜線部空間に流入したトナーが再び該最短間隙から出ていくような流れが生じ、該斜線部空間内のトナーの密度が十分高まらない。このためトナーが供給ローラと現像ローラ 2 の間を通過しようとする圧力が低く、現像ローラ 2 に対するトナー付着量が不安定になってしまう。このように、上記 2 本の供給ローラ 4 a、4 b の最短間隙を 0. 2 ~ 2 mm の範囲に設定した場合には図 1 0 の該斜線部空間内のトナー密度が安定的に保たれるため、ベタ現像後は速やかにトナー付着が回復し、また図 9 (b) の白抜き矢印で示したトナーの還流が良好に行われ、薄層化ブレード 3 トナー規制機構や下側シール機構の簡便化が図られる。

【 0 0 6 2 】なお、図示の例では、トナーホッパー側と下供給ローラ 4 b との間に、下ケース上面から伸びる仕切り部 6 a が形成されている。

【 0 0 6 3 】図 1 1 は、本実施形態に係る現像装置の改良例の説明図である。この改良例では、現像ローラ 2 に接触して回転する 2 本の供給ローラ 4 a、4 b が現像時にそれぞれ別の電位に設定され、電圧印加装置により下供給ローラ 4 b より上供給ローラ 4 a 側へ使用トナーを供給するような電位設定になっている。これは 2 本の供

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給ローラ 4 a、4 b にはさまれた領域において正規に帯電した (ここではマイナス) トナーのみ下流域の上供給ローラ 4 a 側へ送り込み、未帯電または逆極性 (ここではプラス) に帯電したトナーは上流域の下供給ローラ 4 b 側へ送ることで供給ローラおよび現像ローラ 2 と接触、摩擦させ正規に帯電する機会を増加させている。このようにすると湿度の高い環境下などでトナーの帯電量が低い場合でもトナー層に未帯電トナー等が混入が少なく、結果としてトナー層表面から現像ユニットの外へ飛散するトナーを低減できる。そしてベタ現像等で現像ローラ 2 上トナーが消費されても速やかにトナー付着が回復し、常に一定の画像濃度が得られる。

【 0 0 6 4 】図 1 2 は、他の改良例の説明図である。この例では、図 1 2 (b) に示すように、現像ローラ 2 に接触して回転する 2 本の供給ローラ 4 a、4 b の長手方向の接触長さが上流に位置する下供給ローラ 4 b より下流に位置する上供給ローラ 4 a の方が長くなるようにしている。各供給ローラ中の斜線で示した部分は現像ローラ 2 との接触部分である。2 本の供給ローラ 4 a、4 b の間に挟まれた領域はトナーの圧力が高く端部においてはトナーが吹きだそうとする。トナーの進む向きは矢印で示している。この改良例とは異なり図 1 2 (a) のように 2 本の供給ローラ 4 a、4 b の長手方向の長さが等しいか、あるいは、下位置にあってトナーの搬送の上流に位置する下供給ローラ 4 b の方が長いと、端部よりのトナーの吹きだし方向として上方の薄層化ブレード 3 端部へ向かうものが生じる。薄層化ブレード 3 と現像ローラ 2 が当接している端部にトナーがふりかかる状態が継続されると図 1 3 に示す白抜き矢印 E の向きにトナーが現像ユニット外へ漏れだして装置内を汚染してしまう。これと異なり、図 1 2 (b) のようにトナー搬送の下流に位置する上供給ローラ 4 b の方が現像ローラ 2 に対する当接長さが長いと、トナーの吹き出す方向が下向きになり、薄層化ブレード 3 端部よりトナーの漏れ出しが防止できるようになる。また下側に吹きだしたトナーは下供給ローラ 4 b によって再びトナー収容器側へ戻されて攪拌されるため、ユニット端部にトナーが片のようなことは無い。

(以下、余白)

【 0 0 6 5 】なお、図 1 4 に示すようにブレード端部の現像ローラ 2 と薄層化ブレード 3 のへの当接部にスポンジのシール部材 6 1 を挟み込むことでトナーの漏れ出しを防止することができる。

【 0 0 6 6 】図 1 5 は、更に他の改良例の説明図である。この例では、現像ローラ 2 の端部に接触して押圧するシール部材 6 0 を備えており、図 1 5 (b) に示すように該シール部材 2 3 の周方向の長さ L_2 は該 2 本の供給ローラ 4 a、4 b 2 1、2 2 によって挟まれた部分の周方向長さ L_1 より長くなるようにしている。これは図 1 2 に示したように 2 本の供給ローラ 4 a、4 b の間に

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挟まれた領域はトナーの圧力が高く端部において長手方向側にトナーが漏れ出ようとしている。これを防止するため、図15(a)に示すように現像ローラ2端部に対しシール部材23を接触して押圧する。この時トナーの漏れようとする方向にシール部材が存在するため、図15(b)の断面図に示すようにシール部材60が2本の供給ローラ4a, 4bに挟まれた領域をカバーする。このようにすることで端部からのトナーの漏れを良好に防止できる。

【0067】

【実施例1】以下、実施形態4の実施例について説明する。図9(a)に示す現像装置において、感光体1のスピードは200mm/secで、時計回りに回転させた。現像ローラ2は約210mm/secで、反時計回りに回転させた。上下供給ローラ4a, 4bの最短間隔tは1.5mmに設定した。

【0068】その他の具体的な現像部品特性及び現像条件は次の通りである。

(1) 薄層化ブレード3

- ・材質 ウレタンゴム
- ・厚み 2mm
- ・自由端までのブレード長さ 11mm
- ・ローラに対するブレード食い込み量 0.6mm
- ・ブレード当接部から自由端までの突き出し量 0.5mm

(2) 現像ローラ2 (作成方法) 図4に概略図を示す。

- ・ローレットタイプで、ローラ径は20mmで、アルミ芯金に0.3mmピッチ、深さ0.1mm、溝巾0.2mmで45度の角度でアヤメローレット加工を行う。
- ・誘電層コートはエポキシ変性シリコーン樹脂 (東レSR 2115) をコーティングし、50℃で約90分乾燥する。
- ・ローラ表面を切削しアルミ面51と誘電面52を3:7の割合で露出させる。

(3) 下供給ローラ4a

- ・材料: カーボン練り込み発泡ポリウレタンスポンジローラ
- ・ローラ: 径13mm スポンジ肉厚: 径3mm
- ・食い込み: 0.5mm
- ・対現像ローラ線速比: 0.5倍速 (逆回転)

(4) 上供給ローラ4b

- ・材料: カーボン練り込み発泡ポリウレタンスポンジローラ
- ・ローラ: 径13mm スポンジ肉厚: 径3mm
- ・食い込み: 1mm
- ・対現像ローラ線速比: 0.8倍速 (順回転)

(5) 現像ギャップ

- ・150 μ m (感光体はドラムタイプを使用)

現像バイアス

- ・直流-750V

(6) 感光体ドラム1

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・感光体種類: OPC

・表面電位: 地肌部-850V、書き込み部 (画像部) -100V

(7) トナー7

・非磁性スチレンアクリル系+ポリエステル系樹脂使用のマイナス帯電トナー体積平均粒径: 10 μ m

・外添剤: 疎水性シリカ微粉末 0.7wt%添加

【0069】上記実施例1によれば、2本の供給ローラと現像ローラに挟まれた空間内で常にトナーの供給粉圧が生じる状態になった。このためベタ画像を連続して形成してもトナー供給不足による画像濃度の低下は生じなかった。また、薄層化ブレード3の下方にはトナーが溜らず、簡易なブレードにより常にトナー層厚を一定に保つことができた。また下供給ローラ4bよりトナーをホッパー側に戻す流れが生じ、現像ローラ2の下部にも特にシール部材は必要なかった。

【0070】

【実施例2】実施例1と同様な現像器と現像部品を用いるが、現像時の現像ローラ2電位を-750V、下供給ローラ4b電位を-950Vに設定する。上供給ローラ4bは現像ローラ2と同電位である。そして感光体及び現像ローラ2線速度を330mm/secに上昇させて画像形成を行ったが、図10の薄層化ブレード上カバー6bや現像ローラ下のユニットアゴ部6cなどに対するトナーの飛散は線速200mm/secの時とほぼ同等であった。このようにトナー飛散が低減されるため、ハイスピードの画像形成装置の作製が可能になる。また現像ローラ2電位を-750Vにしたまま下供給ローラ4bが-850V、上供給ローラ4bが-650Vの条件にしても同様な飛散を低減する効果が得られた。

【0071】

【実施例3】実施例1と同様な現像器と現像部品を用いるが、下側の位置の下供給ローラ4bのスポンジ部分の端部長さは上側の位置の上供給ローラ4bより2mm程度短くなっている。このようにしたところ該2本の供給ローラ4a, 4bの間の端部で上方へのトナーの吹きだしが起きず、図14に示すようにブレード端部の現像ローラ2と薄層化ブレード3のへの当接部にスポンジのシール部材61を挟み込むことでトナーの漏れ出しを防止することができた。

【0072】

【実施例4】実施例1と同様な現像器と現像部品を用いるが、現像ローラ2の長手方向の長さは該2本の供給ローラ4a, 4bのスポンジ長さより長く、該現像ローラ一端部に毛ブラシ状のシール部材が当接している。そして該シール部材の周方向の長さは図15(b)に示すように該2本の供給ローラ4a, 4bに挟まれた領域の周方向長さより長く、該領域を覆うようになっている。このため該2本の供給ローラ4a, 4bのトナー搬送圧力により現像ローラ2の端部方向へのトナーの吹きだしが

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生じてトナーの漏れだしが防止でき、現像器を長期にわたって使用することが可能になった。

【0073】以上、各実施形態の現像装置によれば、帯電不足のトナー 7 によるトナー飛散や画像地汚れが発生することなく、良好な画像を継続して得ることができる。

【0074】

【発明の効果】請求項 1 の現像装置によれば、第二現像剤供給部材と該現像剤担持体との対向部を現像剤が通過後、該現像剤担持体上に担持されなかった現像剤が、該現像剤貯溜部側に移動するので、該第二現像剤供給部材の上方に現像剤が滞留したままである場合とは異なり、該現像剤担持体と該現像剤規制部材との間に現像剤が過剰に入り込むことが防止され、該第二現像剤供給部材と該現像剤担持体との間で所望の層厚に規制された現像剤のみが、更に該現像剤規制部材で薄層化される。これにより、従来装置に比して、該現像剤担持体に対する該現像剤規制部材の接触圧を維持するための構造を簡単化することができる。また、該現像剤担持体と該第一現像剤供給部材との接触領域で、該第一現像剤供給部材によつて該第一現像剤供給部材の下方に掻き落された現像剤が、該現像剤貯蔵部側へ戻るように移動するので、該下第二現像剤供給部材の下方に現像剤が滞留したままである場合とは異なり、該現像剤担持体の下部に現像装置外へ現像剤が飛散する恐れはなく、現像剤飛散を防止するシール部材を設ける必要がなくなる。

【0075】特に、請求項 2 の現像装置によれば、上記第一現像剤供給部材の間に常に現像剤溜りを形成することによって、この現像剤溜りから該現像剤担持体に現像剤が確実に供給され、例えば、ベタ現像によって多量に現像剤が消費されたとしても、ベタ現像後に該現像剤担持体上に供給される現像剤が不足することがなく、また、該現像剤担持体上に現像の履歴が残ることもなくなる。

【0076】また、請求項 3 の現像装置によれば、現像剤搬送部材と現像剤担持体との間を通過し、該現像剤搬送部材の上方に移動した現像剤を円滑に該現像剤貯溜部側へ戻すように搬送するので、現像剤が該現像剤搬送部材の上方で滞留するような場合とは異なり、現像剤規制部材と該現像剤担持体表面との間に詰め込まれることを防ぐことができ、現像剤規制部材の構造を簡単化することができる。

【0077】また、請求項 4 の現像装置によれば、現像剤搬送部材と現像剤担持体との間を通過し、該現像剤搬送部材の下方に掻き落された現像剤を、該現像剤搬送部材が円滑に該現像剤貯溜部側へ戻すように搬送するので、該現像剤搬送部材の下方に掻き落された現像剤がそのまま滞留することがなく、現像器からの現像剤飛散を防止することができる。よって、該現像剤担持体の下部に現像剤飛散防止用のシール部材を設ける必要がなくな

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る。

【0078】また、請求項 5 の現像装置によれば、発泡樹脂の発泡セル内に現像剤を保持することができるので、第一現像剤供給部材では掻き取り効率が向上し、現像剤掻き取り不良による現像履歴の発生を防止することができる。また、前記第二現像剤供給部材では前記発泡セル内に現像剤を保持して搬送することができるので、現像剤担持体との接触部への現像剤供給効率が向上し、ベタ現像などにより現像剤が多量に消費された場合でも、一回の現像剤供給動作により、前記現像剤担持体上に現像剤を供給し、かつ該現像剤の摩擦帯電を良好に行なうことができ、現像像の濃度不足や濃度ムラの発生を防止することができる。

【0079】また、請求項 6 の現像装置によれば、第一現像剤供給部材については駆動トルクを低減させるので、トルク負荷が大きい場合に生じる振動を軽減することができる。また、第二現像剤供給部材については上記現像剤担持体との接触部を通過する現像剤を、更に効率良く摩擦帯電させるとともに、現像剤規制部材通過前の前記現像剤担持体上の付着量を最適化するので、現像像の濃度不足や濃度ムラの発生を防止することができる。

【0080】また、請求項 7 の現像装置によれば、第一現像剤供給部材については肉厚部分の弾性力を弱め、現像後の現像剤担持体上の現像剤掻き取り効率を更に向上させるので、現像剤掻き取り不良による現像履歴の発生を確実に防止することができる。また、第二現像剤供給部材については現像剤担持体上に弾性的に密着させて現像剤帯電・供給効率を更に向上させるので、現像像の濃度不足や濃度ムラの発生を防止することができる。

【0081】また、請求項 8 の現像装置によれば、現像後に現像剤担持体上に残った現像剤を掻き取る第一現像剤供給部材の支持軸のフレやたわみを軽減するので、現像像の濃度不足や濃度ムラの発生を防止することができる。

【0082】また、請求項 9 の現像装置によれば、第一現像剤供給部材によって現像剤担持体と該第一現像剤供給部材との接触部を通過後の該現像剤担持体上に、現像剤が過剰に供給されることを防止でき、かつ現像後の現像剤担持体上の現像剤掻き取り効率を更に向上させるので、現像剤掻き取り不良による現像履歴の発生を確実に防止することができる。また、第二現像剤供給部材によって前記現像剤担持体と前記第二現像剤供給部材との接触部を通過後の該現像剤担持体上に現像剤が過剰に供給されることを防止でき、かつ現像剤帯電・供給効率を更に向上させるので、現像像の濃度不足や濃度ムラの発生を防止することができる。また、

【0083】特に、請求項 10 の現像装置によれば、シール部材を設けることによって、現像装置外への現像剤飛散を確実に防止できるとともに、該シール部材に対して掻き落された現像剤が与える負荷を軽減す

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ることができるので、従来装置に用いられているシール部材よりも該現像剤担持体との密着性が低い簡単な構造のシール部材を使用することができる。

【0084】請求項 11 乃至 14 の現像装置によれば、上記両現像剤供給部材及び現像剤担持体によって囲まれた領域内に所定の現像剤圧を生じさせて、両現像剤供給部材や現像剤担持体との間の現像剤の摩擦帯電が良好に行なえるようにしているので、現像剤担持体上の現像剤層の帯電均一化や層厚一定化が図れ、例えばベタ画像の潜像などの現像剤消費量の多い潜像を現像した場合にも直後の現像にあたって、現像剤担持体上への帯電トナーの供給が追いつかなくなることによる現像画像濃度の低下を防止できる。また、上記現像剤規制部材で現像領域への搬送が規制された現像剤が、上記第 1 及び第 2 の現像剤供給部材のうち上記現像剤担持体による現像剤搬送方向下流側の現像剤供給部材により、現像剤貯蔵部側に戻されるので、現像剤担持体と該現像剤規制部材との間に現像剤が過剰に入り込んでしまう装置に比して、現像剤担持体に対する該現像剤規制部材の接触圧を維持するための構造を簡単化することができる。また、現像領域を通過して現像器内にもどってきた現像剤担持体表面部分から、例えば他方の現像剤供給部材により掻き落とされた現像剤が、該他方の現像剤供給部材により、現像剤貯蔵部側に戻されるので、上記掻き落とされた現像剤がそのまま滞留してしまう装置に比して、現像剤飛散を防止するためのシール部材の構成を簡略化したり、このようなシール部材自体を省略したりできる。

【0085】特に、請求項 11 の現像装置によれば、上記第一現像剤供給部材と第二現像剤供給部材との対向領域における最接近間隔の設定により、上記現像剤担持体に対する供給現像剤量が上記現像剤担持体長手方向で均一に保つとともに、現像剤担持体表面に付着して、上記第 1 及び第 2 の現像剤供給部材のうち現像剤担持体による現像剤搬送方向下流側の現像剤供給部材の接触あるいは近接部を通過する現像剤量を安定させることができるので、現像剤担持体上の現像剤層の帯電均一化や層厚一定化がより一層良好に図れる。

【0086】また、請求項 12 の現像装置によれば、電圧印加手段による上記第 1 及び第 2 の現像剤供給部材間への所定の電界形成により、所望の極性に帯電した現像剤を集中的に速やかに現像剤規制部材側に搬送するので、ベタ画像潜像の現像等で現像剤担持体上現像剤が急速に消費される場合にも速やかに現像剤担持体上の現像剤付着量を回復させて、常に一定の現像濃度を得ることができる。また、上記所定の電界形成により、未帯電または逆極性に帯電した現像剤は、所望の極性に帯電した後に、現像剤規制部材側に搬送するようにするので、湿度の高い環境下などで現像剤の帯電量が低い場合でも現像剤層に未帯電現像剤等の混入が少なく、結果として現像剤層表面から現像装置の外へ飛散する現像剤を低減で

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きる。よって、例えば多層現像剤層を担持した現像剤担持体を高速回転させても現像剤飛散が増加せずハイスピードの画像形成装置に用いることができる。

【0087】また、請求項 13 の現像装置によれば、第 1 及び第 2 の現像剤供給部材の該現像剤担持体に対する接触幅あるいは近接幅の設定により、両現像剤供給部材間に挟まれた現像剤の圧力が高い領域から、現像剤担持体幅方向端部においては外側に吹き出す現像剤の方向を現像剤担持体による現像剤搬送方向上流側に制限するので、現像剤規制部材端部からの現像剤の漏れ出しを防止できる。

【0088】また、請求項 14 の現像装置によれば、第一及び第二の現像剤供給部材の間に挟まれた現像剤の圧力が高い領域から幅方向外側に漏れ出ようとする現像剤の移動を、規制部材によって規制するので、現像剤担持体端部よりの現像剤の漏れだしを防止できる。

【図面の簡単な説明】

【図 1】実施形態に係る現像装置の概略構成図。

【図 2】本発明を適用できる画像形成装置の概略構成図。

【図 3】同現像装置の現像ローラ周辺の拡大図。

【図 4】(a) 及び (b) は同現像装置の現像ローラの説明図。

【図 5】変形例に係る現像装置の概略構成図。

【図 6】(a) は現像ローラと下供給ローラとの接触部の拡大図。(b) は現像ローラと上供給ローラとの接触部の拡大図。

【図 7】他の実施形態に係る現像装置の説明図。

【図 8】更に他の実施形態に係る現像装置の説明図。

【図 9】(a) は更に他の実施形態に係る現像装置の説明図。(b) は同現像装置内でのトナー移動の説明図。

【図 10】同現像装置の特徴部の説明図。

【図 11】同現像装置の改良例の説明図。

【図 12】(a) は同現像装置内でのトナー移動の説明図。(b) は同現像装置の他の改良例の説明図。

【図 13】同現像装置内でのトナー移動の説明図。

【図 14】同現像装置の更に他の改良例の説明図。

【図 15】(a) 及び (b) は同現像装置の更に他の改良例の説明図。

【図 16】(a) 及び (b) は従来例に係る現像ローラの説明図。

【図 17】従来例に係る現像装置の説明図。

【図 18】他の従来例に係る現像装置の説明図。

【符号の説明】

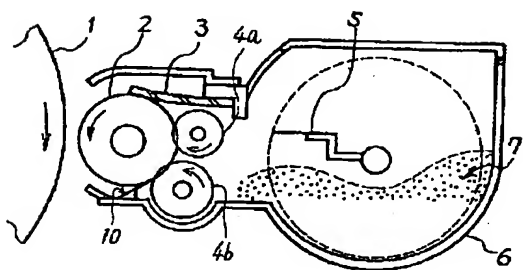
- | | |
|-----|---------|
| 1 | 感光体ドラム |
| 2 | 現像ローラ |
| 3 | 薄層化ブレード |
| 4 a | 上供給ローラ |
| 4 b | 下供給ローラ |
| 5 | アジテータ |

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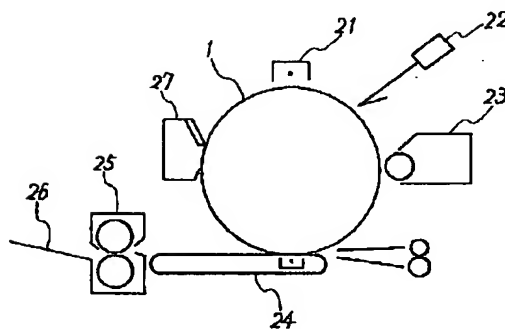
- 31
- 6 トナーホッパー
 - 7 トナー
 - 8 アジテータ
 - 10 シール部材
 - 21 帯電装置
 - 22 露光装置
 - 23 現像装置
 - 24 転写・搬送部材
 - 25 定着装置

【図 1】

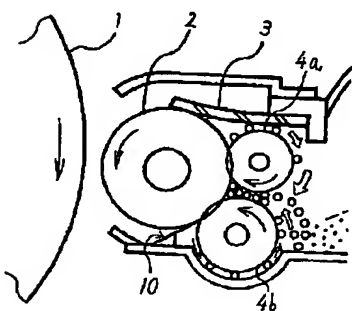


- 32
- 26 排紙トレイ
 - 27 クリーニング装置
 - 41a 上供給ローラ軸
 - 41b 下供給ローラ軸
 - 51 導電部
 - 52 誘電部
 - t 最接近部間隔
 - 60 シール部材

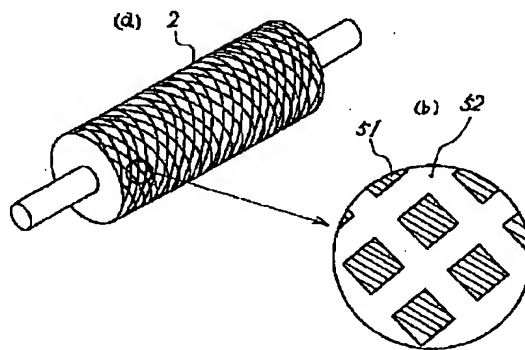
【図 2】



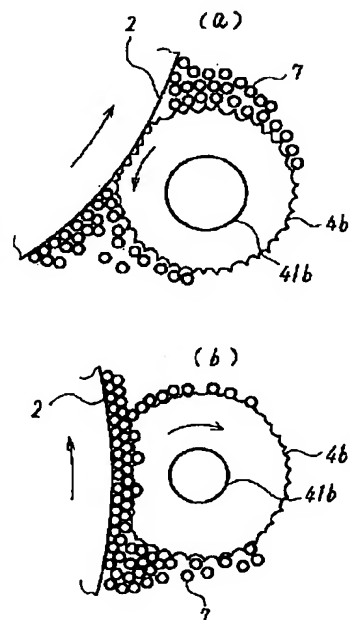
【図 3】



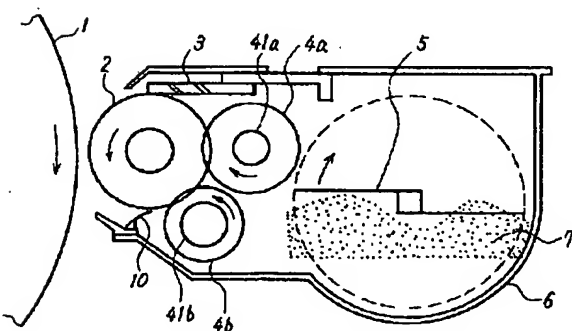
【図 4】



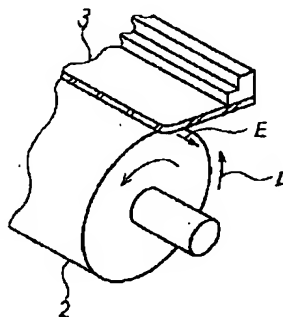
【図 6】



【図 5】



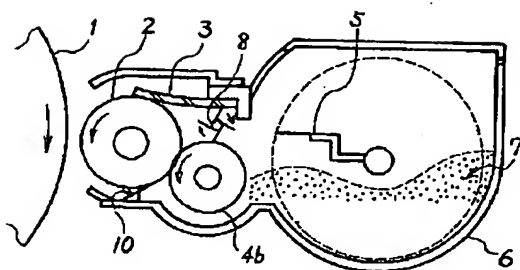
【図 13】



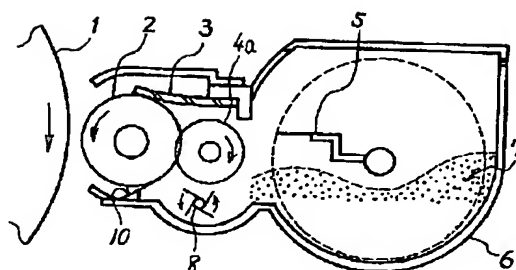
(18)

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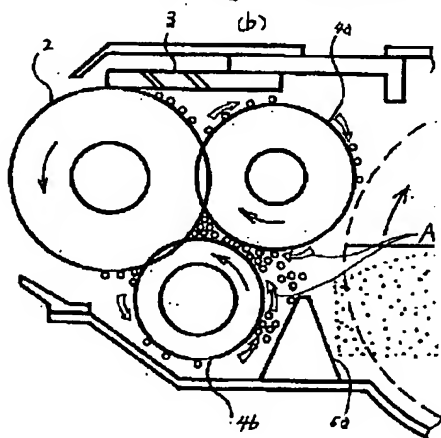
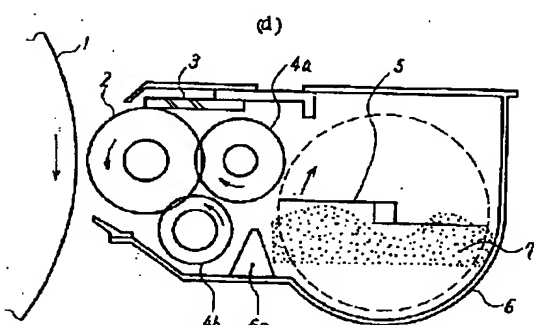
【図7】



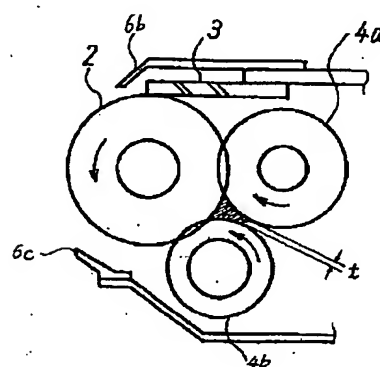
【図8】



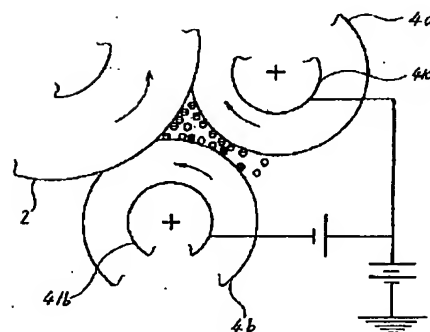
【図9】



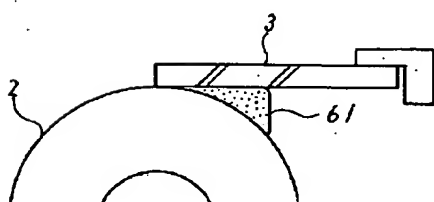
【図10】



【図11】



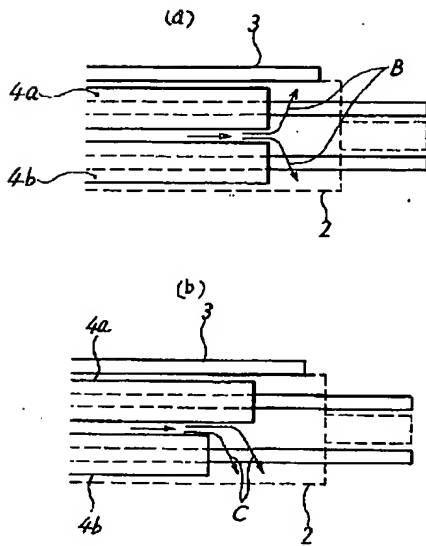
【図14】



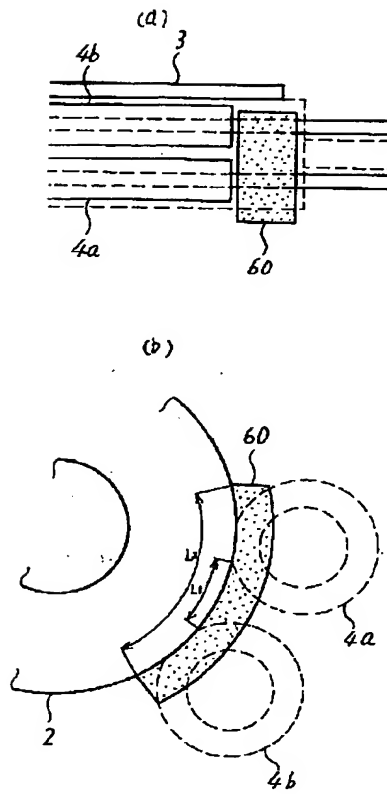
(19)

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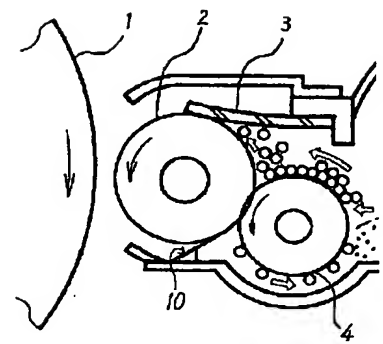
【図 12】



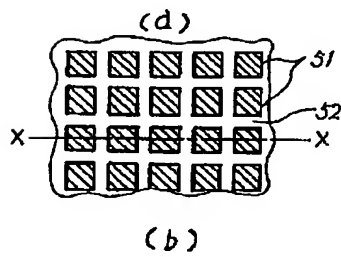
【図 15】



【図 17】



【図 16】



【図 18】

